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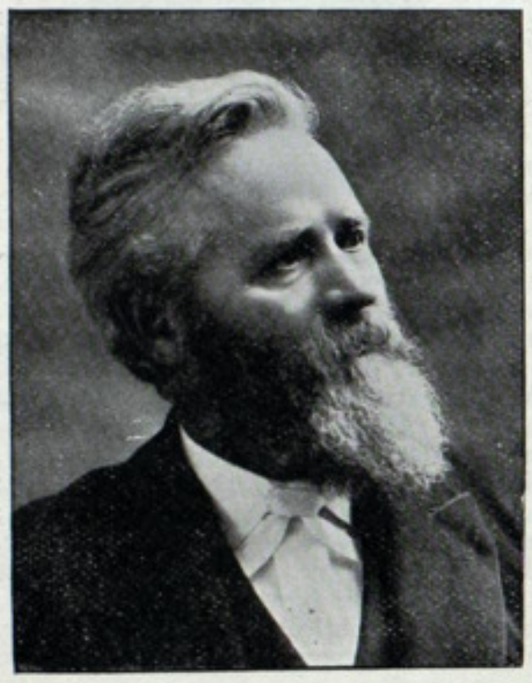
NAVAL ARCHITECTS—MARINE ENGINEERS.

A SOCIETY THAT REFLECTS THE GROWTH OF SHIP BUILDING IN AMERICA—NEARLY 800 MEMBERS IN A FEW YEARS—SUCCESSFUL MEETING IN NEW YORK.

Probably the best evidence of the flourishing condition of the Society of Naval Architects and Marine Engineers, which held its eighth annual meeting in New York on Thursday and Friday last, 15th and 16th inst., is its wonderful growth of membership. The membership has been increasing at the rate of about 100 annually during the past few years, and the total now is about 775. Just before the opening of the meeting last week, at which full 100 names were favorably acted upon, the total was 669, divided as follows: Life members, 5; life associates, 3; members, 368; associates, 244; juniors, 49. The society has cash and investments in bonds amounting to nearly $10,000, and with other resources its present worth is $15,232.17, against which there are no liabilities. These were the main features of the annual report of Secretary-Treasurer Francis T. Bowles. The sessions were held, as usual, in the auditorium of the Mechanical Engineers' building, No. 12 West Thirty-first street, which had been courteously placed at the disposal of the society. President Clement A. Griscom of Philadelphia presided at the opening and closing sessions. At the other two sessions the presiding officers were Charles H. Loring and Charles H. Cramp, vice-presidents. The attendance increases each year, and this last meeting was no exception to the rule. Neither the chief constructor nor chief engineer of the navy found it convenient to attend, and the absence of Mr. Geo. W. Dickie of the Union Iron Works, who contributed a valuable paper, was also regretted, but the younger members of the society are heard in discussion oftener than they were a few years ago, and as their number increases interest is certain to grow in the meetings. Naval Constructor Bowles was again highly complimented on all hands for the admirable manner in which all details of the meeting had been arranged. Mr. Bowles announced at the concluding session that one of the members of the council had offered a prize of $100 for the best paper presented in time for the next meeting on "Theoretical and Practical Methods for Balancing Marine Engines." The opening address of President Griscom dealt mainly with progress in ship building. It was not a formal affair. It contained statistics regarding the work of ship yards throughout the country that evidently required considerable labor in their preparation. Mr. Griscom said:



Geo. W. Dickie, Union Iron Works.

ADDRESS OF PRESIDENT CLEMENT A. GRISCOM.

Gentlemen:—I am grateful for the continued evidence of your confidence, which I highly appreciate. The long list of new members we shall add to our rolls at this meeting is but one of the abundant signs to be read in the industrial, financial and political life of these November days, of a national determination to promote ship building, commercial and naval. In pursuit of its special object, this society, I confidently predict, has an immense future of great usefulness to our country. The most prosperous year ship building in the United States has known since the outbreak of the civil war nears its end. The new year and the century about to begin bid fair to witness a development of the industry responsive to our high hopes at the time the Society of Naval Architects and Marine Engineers was founded. During the fiscal year of the government, which ended with June, eighty steel vessels of 167,984 gross tons were built in the United States. These figures are modest compared with Great Britain's output of 567 steel steam vessels of 1,341,425 gross tons during the year, but they are full of encouragement when put beside the fact that during the previous nine years the United States built only 574,802 gross tons of these types. Nearly all our ship yards have been busy, every large plant has increased its capacity and several new ship yards have been established and equipped for the construction of the largest merchant and war vessels. The new ship and engine plant of noble proportions on the Delaware is prepared for work, and its novel applications of mechanical science to ship building have already aroused the interest of the students of marine architecture here and abroad. A new and extensive plant on the Pacific coast will soon begin operations, and on the Thames in Connecticut the keels of two of the largest steamships ever built will soon be laid. Plants in the south are increasing their facilities and under favorable conditions steel ship building promises to become one of our distinctively national industries. The next twenty-four months will show an increase over the past twenty-four months as great as the records of the latter exceed those of the previous periods. Since the end of June there have been launched, begun or contracted for, seventy-eight steel steamships of 350,000 gross tons, including ten ocean steamships, each of 10,000 gross tons or over. Part of this work will extend over a period of two years, but in the twelve-month since last June, 250,000 tons of steel steamships will have been launched in the United States.

Unless I mistake its scope this society has two functions—first by the interchange of professional ideas to extend our own knowledge and familiarize ourselves with advances in the technical aspects of the art, and second, to promote ship building by teaching the value to the nation of the work in which we are directly or indirectly engaged, and by developing a correct popular understanding of the broad facts of the industries with which we are identified. You will not expect a technical paper from me. Such papers have been prepared for the meeting by gentlemen whose abilities in their respective lines of work command the highest professional esteem. But as your president I deem it well at this time to point out some of the causes which, in my judgment, have brought the recent remarkable growth in American ship building, to which the figures just stated testify. Most familiar among these causes has been the liberal and continued expenditure of the government on the navy. Since 1884-5 seventy-one vessels of over 360,000 tons displacement, not including many torpedo boats and torpedo boat destroyers, have been built or ordered for the navy. The vessels under construction aggregate 113,326 tons displacement, namely, six battleships, four monitors, six protected cruisers, sixteen torpedo boat destroyers and fifteen torpedo boats, a total of forty-seven. The total value now under construction for the navy for hulls and machinery alone involves an expenditure of $33,700,000. Of vessels authorized but not yet begun, there are five battleships, six armored cruisers, and three protected cruisers, or fourteen in all, aggregating 179,800 tons displacement, of which hulls and machinery alone will cost approximately $50,400,000, a greater amount than is involved in the entire construction of the merchant steamships of twenty-four months to which I have referred.

The annexation of Hawaii and causes arising from our war with Spain have stimulated ship building beyond the expectations of the sanguine a few years ago. Among such causes are the extension of the coasting laws to Porto Rico, the development of closer relations with Cuba, the absorption of a large tonnage by the government for transport purposes, and especially the certainty that the United States is now impelled by the force of events to assume first rank as a maritime commercial power on the Pacific.

Under legislative conditions, which insure them against internal competition and have obtained for them deep channels, our ship builders on the great lakes have brought the art to a wonderful perfection. Of the increase of 750,000 tons in American shipping during the decade, 500,000 tons (450,000 of which are steel steam vessels) stand to the credit of the ship builders and ship owners of the great lakes.

Without transgressing an unwritten rule of the society in discussions, I feel justified in stating that among the causes which are now stimulating our shipping interests may be included the growing popular national sentiment that the United States should no longer remain at the tail of the procession of commercial nations on the seas. Within four years our country has won a series of remarkable industrial triumphs, yet Japan, the youngest of nations, surpasses us in the tonnage of ocean steamships engaged in the world's commerce. I shall not presume to discuss here the public measures that may be desirable to meet the situation. Papers will be laid before you on certain phases of the problem, to which your thoughtful attention is invited. I have shown that conditions exist which promise success for a well-considered project, sustained by enlightened public sentiment. I congratulate the members upon a program of unusual interest.

Chief Constructor Philip Hichborn.

President Griscom's address was very warmly received. All officers of the past year were re-elected. Mr. Walter A. Post of the Newport News Ship Building & Dry Dock Co. was made a member of the council. The list of officers is as follows:

President—Clement A. Griscom.

Vice-Presidents—Charles H. Cramp, Philip Hichborn, Chas. H. Loring, George W. Melville, George W. Quintard, Irving M. Scott, Frank L. Fernald, Francis M. Bunce, Wm. T. Sampson, Edwin A. Stevens.

Members and Associate Members of the Council—Wm. F. Durand, Francis T. Bowles, French E. Chadwick, H. Taylor Gause, Nathaniel G. Herreshoff, William H. Jacques, John C. Kafer, Frank B. King, Frank E. Kirby, Jacob W. Miller, Washington L. Capps, Edward Farmer, Lewis Nixon, Harrington Putnam, W. I. Babcock, Horace See, E. Platt Stratton, Stevenson Taylor, George E. Weed, James E. Denton, Walter M. McFarland, Geo. W. Dickie, Cecil H. Peabody.

Executive Committee—Francis T. Bowles, chairman; H. T. Gause, Harrington Putnam, Lewis Nixon, Edwin A. Stevens, Clement A. Griscom, ex-officio.

Secretary and Treasurer—Francis T. Bowles, U. S. N., 12 W. 31st st., New York.

A LIST OF MEMBERS AND OTHERS IN ATTENDANCE.

Among foreign visitors at the meeting were Lieutenant-Commander De Faranand of the French navy, Lieutenant-Commander Von Rebeur Paschwitz of the German navy, Capt. Stchensnovitch, Capt. Beher and Naval Constructors Tschernigofsky and Mackdousky of the Imperial Russian navy, Commander Fitz Graham of the Swedish navy.

The list of members and others in attendance at the several sessions for the reading of papers and at the banquet included the following: Charles H. Haswell, Clement A. Griscom, Francis T. Bowles, Charles H. Loring, Charles H. Cramp, Lewis Nixon, W. M. McFarland, W. D. Forbes, Miers Coryell, Prof. A. H. Sabin, Naval Constructor J. J. Woodward, Henry G. Morse, Spencer Miller, John C. Kafer, W. I. Babcock, Naval Constructor J. G. Tawresey, J. R. Andrews, Commander B. F. Wood, U. S. N.; Naval Constructor Wm. J. Baxter, F. L. Dubasque, Col. Wm. P. Stephens, E. Platt Stratton, Capt. C. J. Train, U. S. N.; Naval Constructor Joseph H. Linnard, Naval Constructor W. L. Capps, Prof. Wm. F. Durand, Naval Constructor H. G. Gillmor, Chief Engineer A. Kirby, U. S. N.; F. Meriam Wheeler, Stevenson Taylor, Harrison S. Taft, Wm. H. Jacques, Naval Constructor J. B. Hoover, Capt. A. Troomp, Aaron Vanderbilt, Capt. H. S. Ross, U. S. N.; Frank B. King, H. B. Roelker, John Platt, James Young, B. F. O'Connor, Prof. C. H. Peabody, George N. Gardiner, H. L. Des Anges, Theodore Lucas, E. E. Roberts, E. G. Roberts, J. W. Kellogg, J. J. Lynn, Naval Constructor W. L. Mintony, Albert Leitch, Chas. H. Buckeleu, G. R. Ferguson, Chief Engineer E. A. Magee, S. S. Jordan, Chief Engineer Henry W. Fitch, Assistant Naval Constructor H. G. Smith, Horace See, Naval Constructor Lawrence Spear, Asst. Naval Constructor J. W. Powell, Asst. Naval Constructor H. L. Ferguson, C. D. Mosher, Sinclair Stuart, Capt. Jacob W. Miller, R. C. Veit, John W. Shackford, Alfred G. Smith, Jarvis B. Edson, Geo. E. Weed, Thomas Congdon, Wm. Nish, J. Cummings, G. Sims, Wm. Dickey, Geo. L. Norton, Walter B. Pollock, M. P. Leviathan, James G. Winship, L. Katzenstein, Samuel J. Clarke, H. E. Boucher, W. R. C. Wood, Alex. J. Maclean, Otto B. Keller, Chas. B. Edwards, J. W. McCormick, G Hillman, H. Hillman, Asst. Naval Constructor R. M. Watt, Carroll S. Smith, T. S. Bailey, H. S. Epes, Nicholas Cushing, F. B. Southard, James A. Hargan, P. j. Donnelly, F. C. Whitehouse, Julius Jonson, Gordon B. West, J. M. Lincoln, H. Stevenson, John Lloyd, W. G. Shackford, Warren E. Hill, A. Gunderson, H. Konitzky, H. Canfield, T. C. Zerega, Wm. H. Deming, Wm. A. Dobson, F. D. Herbert, E. S. Denise, Thos. Keough, Chas. B. Rowland, Geo. Rowland, F. S. Brinton, John J. Nolan, F. P. Lewis, Wm. Chauncey, H. F. Donaldson, Henry Steers, Wm. B. Beckley, Andrew Fletcher, Andrew Fletcher, Jr., Wm. H. Fletcher, W. J. Chalmers, E. H. Whitney, A. W. Goodrich, Gardiner Williams, L. D. Davis, Geo. P. Wilson, Howard Pusey, Darwin Almy, A. R. Smith, L. Jessup, P. Symington, Samuel Putman, Wm H. Harrison, Chas. M. Englis, James T. Boyd, E. P. Robinson, Wm. Frazer, Major Wiley, Wm. Wiley, H. A. Magoun, C. P. Witherbee, H. G. Skinner, W. Clark, Wm. H. Bailey, C. P. Paulding, J. Gordon Emmons, E. Johnson, J. C. Summers, J. J. Crain, Wm. R. Sattler, E. H. Ewertz, H. Ward Stanton, S. W. Stanton, W. L. Buckley, W. E. Kimball, C. S. Butts, Joseph Barre, J. A. Sedgwick, Chas. Doan, A. Brown, W. A. Dripps, C. H. Randebrock, Howard Wood, J. Caldwell, L. Jessup, F. H. Stillmon, Austin Stillmon, Wm. Beers, D. G. Moore, T. F. Rowland, T. F. Rowland, Jr., Wm. F. Palmer, Arthur Masters, Capt. L. W. Robinson, James C. McGuire, M. Fargusson, W. W. Ackerman, Donald Stuart, M. F. Moore, Robt. W. Steele, Edward McIntyre, R. Clark, J. A. Clifford, Jas. R. Raymond, Thos. E. Webb, W. Blackfurn Smith, H. Meeker, A. P. Baller, D. G. Moore, Chas. W. Martin, Jr., F. G. Hall, Jr., A. J. Oliver, A. B. Moore, Frank Nicols, John S. Griggs, L. Eckert, John F. Kone, F. G. Hall, Jr.

Naval Constructor D. W. Taylor.

A LONG LIST OF NEW MEMBERS.

The list of new members, associates and juniors, and the advancements in membership are as follows:

Members—C. H. Bartlett, navy yard, 9 Concord square, Boston; Max H. Bauer, Royal Technical High School, Berlin, Germany; F. L. Bigelow, the Bigelow Co., New Haven, Conn.; C. B. Brewer, Maryland Steel Co., Sparrow's Point, Md.; C. H. Buckelew, Ashton Valve Co., 126 West Fifth street, Plainfield, N. J.; Fred M. Cook, Bath Iron Works, Bath, Me.; Hulbert Cop, Polytechnical school, Delft, Holland; Chas. H. Davis, 90 Cedar street, New York; Thos. S. Hall, New York & Texas S. S. Co., 16 Burling Slip, New York; F. D. Herbert, 220 Broadway, New York; Edward Hopkins, Detroit Ship Building Co., Detroit, Mich.; G. B. Hunter, C. S. Swan & Hunter Co., Ltd., Wallsend-on-Tyne, England; Raimondo Lignola, Royal Italian navy, R. Cantiere di Castellamare di Stabia, Italy; H. P. Norton, navy department, Washington; W. F. Palmer, 27 Hartford street, Dorchester, Mass.; Sven Pauli, Carlskrona navy yard, Carlskrona, Sweden; E. R. Pommer, navy yard, Boston; R. R. Row, marine department, United States light-house service, 227 S. Broadway, Baltimore; S. A. Savage, United States light-house board, Washington; J. T. Scott, Union Iron Works' shops, San Francisco; Wm. F. Thumm, Wm. Cramp & Sons Co., Philadelphia; C. P. Wetherbee, Bath Iron Works, Bath, Me.; C. H. Wheeler, Wheeler Condenser & Engineering Co., 120 Liberty street, New York; J. G. Winship, Geo. F. Blake Manufacturing Co., 468 Greene avenue, Brooklyn; Wm. H. Woody, Jr., Wm. R. Trigg Co., Richmond, Va.; W. B. Smith, Crescent ship yard, Perth Amboy, N. J.; H. L. Ebsen, 230 West street, New York; C. C. Thomas, University of New York; M. Pfatischer, Electro Dynamic Co., Philadelphia; Frank O. Wellington, Fore River Engine Co., Weymouth, Mass.; H. P. Elwell, Fore River Engine Co., Weymouth, Mass.

Advanced from associate to member—L. M. Michael, 1514 Van Buren street, Wilmington, Del.; W. M. Wallace, 616 Eighteenth street N. W., Washington; Frank B. Zahm, naval constructor, navy department, Washington; G. H. Wilson, Harlan & Hollingsworth Co., Wilmington, Del.; Spencer Miller, Lidgerwood Mnfg. Co., New York; H. L. Ferguson, assistant naval constructor, Washington.

Associates—C. W. Buckelew, 126 West Fifth street, Plainfield, N. J.; Henry Capdevielle, 113 Thirty-third street, Newport News, Va.; F. A. Coolidge, Harlan & Hollingsworth Co., Wilmington, Del.; P. G. Cooper, 124 Thirty-fifth street, Newport News, Va.; H. B. Etter, 2339 North Twentieth street, Philadelphia; Capt. Wm. Baron Fergen, naval attache, Imperial Russian embassy, 2010 R street, N. W., Washington; Albert N. Gibson, navy yard, Boston, Mass.; W. D. Greene, Bath Iron Works, Bath, Me.; S. Cuyler Greene, Hyde Windlass Co., Bath, Me.; John W. Hoffman, Hoffman Engineering & Contracting Co., Harrison building, Philadelphia; L. M. Hooper, J. L. Mott Iron Works, Rutherford, N. J.; Arthur C. Lawley, Geo. Lawley & Son Corp., South Boston, Mass.; James J. Lynn, 4 Butler street, Port Huron, Mich.; H. S. New, 221 Newbury street, Boston; John J. Nolan, 271 Adelphi street, Brooklyn; Johan H. Norman, Wm. Cramp & Sons Co., Philadelphia, Pa.; Cecil E. Paine, Hyde Windlass Co., Bath, Me.; W. L. Pierce, Lidgerwood Manufacturing Co., 96 Liberty street, New York; W. F. Powers, Harlan & Hollingsworth Co., Wilmington, Del.; A. A. Raven, American bureau shipping, 37 William street, New York; R. H. M. Robinson, assistant naval constructor, Cramps ship yard, Philadelphia; W. Harry Roes, Wm. Cramp & Sons Co., Philadelphia; A. H. Sabin, Edward Smith & Co., 45 Broadway, New York; W. G. Shackford, retired shipmaster, South Orange, N. J.; C. H. Thayer, 136 Thirty-eighth street, Newport News, Va.; T. H. A. Tromp, 1302 Washington street, Hoboken, N. J.; A. A. Thresher, Thresher Electric Co., Dayton, O.; Emil L. Boas, 37 Broadway, New York; Charles E. Ross, Morgan Iron Works, New York; Stedman Bent, Maryland Steel Co., Sparrow's Point, Md.; F. Bent, Solid Steel Casting Co., Chester, Pa.; S. W. Roach, Morgan Iron Works, New York; C. V. Schooler, 511 County street, Portsmouth, Va.; Alex. Hughes, 623 Jefferson street, Portsmouth, Va.; G. B. West, Eastern Ship Building Co.; New London, Conn.; W. B. Pollock, marine department, N. Y. C. & H. R. R., New York; W. C. Farrington, Northern Steamship Co., Buffalo; Archibald MacNicol Main, Eastern Ship Building Co., New London, Conn.; L. W. Stanton, Nautical Gazette, New York; GeH. Waters, assistant master mechanic Pennsylvania Co., Jersey City, N. J.; Hugh Patteson and Geo. H. Hill, Sprague Electric Co., New York; James A. Clifford, B. F. Sturtevant Co., Boston; James D. McBride, New York Ship Building Co., Camden, N. J.; S. W. Wakeman, Newport News ship yard, Newport News, Va.; Truman H. Newberry, Detroit.

Advanced from junior to associate—B. C. Tuthill, Bath Iron Works, Bath, Me.; H. A. Swanton, Harlan & Hollingsworth Co., Wilmington, Del.

Advanced from junior to member—H. W. Delong, marine department, Maryland Steel Co., Sparrow's Point, Md.; Austin Sperry, Fulton Engineering & Ship Building Co., San Francisco.

Juniors—A. E. Baum, 32 Western avenue, Bath, Me.; A. C. Leitch, navy yard, New York; James A. Bimson, Bath Iron Works, Bath, Me.; John Jay Crain, 329 Forty-ninth street, Newport News, Va.; E. O. Cutler, 97 Oak street, Bath, Me.; E. O. Damon, Jr., 83 Pomeroy terrace, Northampton, Mass.; N. E. Dawson, Jr., 3406 West avenue, Newport News, Va.; Walter L. Ellis, Bath Iron Works, Bath, Me.; John L. Evans, P. O. Box 838, Bath, Me.; John F. Frieble, P. O. Box 60, Newport News, Va.; H. E. Grieshaber, P. O. Box 92, Newport News, Va.; H. L. Hibbard, naval constructor office, Newport News, Va.; Charles H. Hughes, 658 Washington street, Bath, Me.; H. R. Hunt, 719 St. Nicholas avenue, New York; S. C. Jenkins, Wm. R. Trigg Co., Richmond, Va.; Allen Loomis, Hanley Construction Co., Quincy, Mass.; Robt. W. Lord, 25 Linden street, Bath, Me.; L. R. Mitchell, 476 Middle street, Bath, Me.; W. B. Newton, 850 Washington street, Bath, Me.; F. Schoonmaker, 146 Oak street, Bath, Me.; C. B. Page, Maryland Steel Co., Sparrow's Point, Md.; H. C. Wright, Jr., Wm. R. Trigg Co., Richmond, Va.; Clifton Yeomans, P. O. Box 60, Newport News Va.; W. J J. Young, 15 Cottage Side, Dorchester, Mass.

Naval Constructor J. J. Woodward.

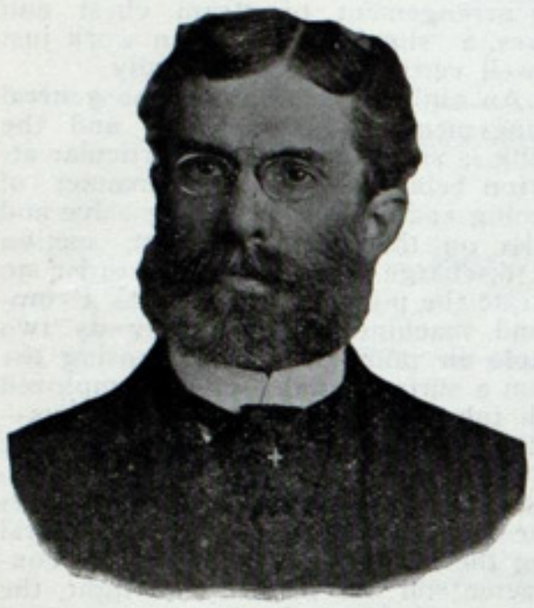
READING OF PAPERS.

FIRST ON THE PROGRAM WAS A VALUABLE CONTRIBUTION FROM MR. CHAS. H. CRAMP, COMPARING THE PERFORMANCE OF THE VARIAG WITH THAT OF OTHER FAST PROTECTED CRUISERS.

It was announced before the reading of papers that guests of the society were cordially invited to take part in the discussion; that each speaker would be allowed one period of ten minutes for each paper or subject, and that rejoinders were in order only by writers of papers to answer questions in closing the discussion. Although not on the program the first paper proved highly interesting. It was the "Performance

of the Imperial Russian Cruiser Variag," by Charles H. Cramp, head of the Wm. Cramp & Sons Ship & Engine Building Co. of Philadelphia, builders of the vessel. It was not expected until about the opening of the meeting that Mr. Cramp would be able to attend and therefore the paper was not announced. The feature of the paper was a table embracing comparisons between the Variag and other high speed protected cruisers. Mr. Wm. A. Dobson of the Cramp company, reading for Mr. Cramp, said:

"The recent performance of the Russian cruiser Variag, designed by me and built under my direction, and the extremely drastic conditions under which that performance was attained seem to represent an advance distinct enough to warrant the attention of this society. This high performance was due to the most perfect adaptation of her form or model to the attainment of the extraordinary speed required; to the excellent performance of her engines and boilers, and also to the best and most equitable arrangement of structural appliances in her hull to secure the greatest strength with least weights, and to the fact that in her design every pound of weight was put where it would do the most good. The fine modeling of the hull was shown in the fact that 24 knots, over a ten-knot course, was attained with 18,000 I.H.P., and the speed of 23¼ knots was easily sustained for twelve consecutive hours with a mean I.H.P. of 16,000. The subject necessarily involving a great mass of detail, which would be tedious if discussed at length, I offer for your consideration a group of facts which for convenience and also for perspicuity I have condensed into the form of comparative tables—No. 1 and No. 2. These tables embrace comparison between the Variag of the Imperial Russian navy on the one hand and the Minneapolis and the Olympia of our navy, the Terrible and Diadem of the British navy, the Blanco Encalada of the Chilian navy and the "25 de Mayo" of the Brazilian navy—the four last named ships being English built. The comparisons include: Dimensions and displacement; indicated horse power, speed, duration of trial, coal capacity and coal used on trial; power of battery; complement of men; type of boilers and engines; weight of hull, boilers and engines, in tons; weight of ordnance, in tons; weight of equipment and outfit, in tons; weight of coal, in tons; total weight of ordnance, coal, equipment and outfit, in tons; percentage of weight of ordnance, coal, equipment and outfit to weight of hull, boilers and engines; percentage of coal to trial displacement; percentage of ordnance to trial displacement; and conditions under which steam was generated.



Mr. F. Meriam Wheeler.

"As I intimated at the outset, it is not my intention to take up your time with an elaborate analysis of the comparative table which I offer. The few facts to which I care to call your special attention are: First, that no full-speed trial has hitherto been required of twelve hours duration under natural draft, and second, that nothing approximating the speed developed by the Variag has ever before been attained in any vessel or required by any contract to be effected under natural draft alone. To the first of these statements I might add that in the contract for the construction of the Variag it was stipulated that a speed of 23 knots per hour for twelve hours might be attained in two runs of six hours each, with a short interval between them sufficient to rest the fire and engine room forces a little, but prohibiting any overhaul or changing of any kind in the boilers and machinery during the interim. As it turned out, we did not consider it worth while to avail ourselves of the intermission, but ran the whole trial continuously over the twelve hours. It might also be within the bounds of propriety to suggest that the extraordinary performance of the Variag under the remarkable conditions that were imposed, cannot be taken by our own government as a standard, if they adhere to the scale of statutory limitations of cost hitherto incorporated in the acts of congress authorizing naval vessels. The Russians, while making drastic requirements, were also willing to pay the price necessary to obtain what they wanted. I am free to say that the statutory limitations hitherto placed upon the cost of vessels of approximately similar class to the Variag would prohibit the building of such a ship within such limitations. It might be proper, even at the risk of expanding my comment more than I had originally intended, to say that if we divide the weights carried on the official trial displacement into two groups, one of which will include the fixed weights or those necessarily devoted to the hull and machinery and the other of weights of ordnance, coal, equipment and outfit, as in table No. 2, which may be summed up under the term of load carried at trial displacement, we find that the load carried in the case of the Variag exceeds that of any other vessel given in the table. To show this more clearly, the weights of coal, equipment, etc., are given in a percentage of the fixed weights. In the Variag this percentage is 37.4, the next highest being the Terrible with 32.6 and ranging down through various ships to 18.7 in the Olympia. Analyzing these results we find two important facts, namely, that the load of the variable weights of the Variag are exceedingly high and that the weight of hull and machinery is comparatively low.

"By reference to the table it will be seen at once that the displacement in this vessel devoted to coal and ordnance is extraordinarily high, being unequalled by any vessel of her class hitherto constructed. The fact of carrying 12 per cent. of the displacement in coal at trial draft is unparalleled in modern cruisers of high speed in all classes. The great weight of ordnance carried is equalled only by the Blanco Encalada of the Chilian navy, built by Armstrong. It is here more than in any other particular that the Variag becomes a triumph of architectural and engineering skill. Recurring to the table we find that the percentage of displacement devoted to the hull and machinery of vessels fitted with water tube boilers is as follows: In the Variag, 72.8 per cent., with speed of 23¼ knots, 12 hours trial; in the Terrible, 75.4 per cent., with speed of 22 knots, 8 hours trial; in the Diadem, 76.6 per cent., with speed of 20.72 knots, 8 hours trial.

"The value of this reduction of such weights in the Variag to the minimum, without impairing the structural integrity of the hull, and the delicate nature of the task which it imposed, may be better understood when I say that the requirements of the Russian government were that the maximum stresses upon the hull structure must not exceed 5 tons per square inch of material, and that this requirement was carried out with a considerable margin, to the enthusiastic satisfaction of the Russian inspecting officers, notwithstanding the low percentage of such weights to displacement. As further evidence of the perfect structural integrity of the hull, I may say that the water tight compartments have been tested with a maximum head of water equal to that which would be due to immersion of the vessel to the upper deck line. This is a test of unheard of severity, not having been applied to any other ship within my knowledge, but it has been carried out thoroughly and to the entire satisfaction of the inspectors. I speak of this as only one of the conditions to be dealt with in calculating and preparing the scantling sizes of the hull. Another fact of great interest in this connection is that the vertical vibrations of the hull at varying speeds were, at the maximum, very small, and under most conditions practically imperceptible. All of these results have naturally been alike gratifying to the officials of the Russian ministry of marine and to me, and I take pleasure in presenting them for the consideration of this society without further comment."

The tables of comparison presented by Mr. Cramp and which formed a part of his paper, are as follows:

COMPARISON OF PROTECTED CRUISERS—TABLE NO. 1.

	UNITED STATES BUILT.			ENGLISH BUILT.			
	RUSSIAN VARIAG.	U. S. S. MINNEAPOLIS.	U. S. S. OLYMPIA.	TERRIBLE.	DIADEM.	BLANCO ENCALADA.	25 DE MAYO.
Length on load line	419′ 6″	412′	340′	520′	435′	390′	345′
Beam, extreme	52′	58′ 2¼″	53′	71′ 6″	69′	45′ 9″	43′
Trial draft	19′ 6″	22′ 6½″	21′ 6″	27′ 0″	25′ 3″	18′ 5″	16′ 0″
Trial displacement	6465 tons.	*7375 tons.	*5586 tons.	14200 tons.	11000 tons.	4568 tons.	3200 tons.
Indicated horse-power	15925	20862	17313	25000	16961	14500	13800
Speed	23.25	23.07	21.69	22.	20.72	22.80	22.43
Duration of trial	12 hours.	4 hours.	4 hours.		8 hours.	Measured mile.	Measured mile.
Coal capacity	1250 tons.	1891 tons.	1170 tons.	3000 tons.		866 tons.	
Coal on trial	770 tons.	629 tons.	153 tons.	1000 tons.	1000 tons.	350 tons.	300 tons.
Battery:	12-6″ R. F. 12-75mm R. F. 6-47mm. 2-37mm. 2-Field.	1-8″ B. L. R. 2-6″ R. F. 8-4″ R. F. 12-6-Pdr. R. F. 4-1-Pdr. 4-Gatlings.	4-8″ B. L. R. 10-5″ R. F. 14-6-Pdr. R. F. 6-1-Pdr. R. F. 4-Gatlings.	2-9.2″ 12-6″ R. F. 18-12-Pdr. 12-3-Pdr.	16-6″ R. F. 14-12-Pdr. R. F. 12-3-Pdr. R. F.	2-8″ R. F. 10-6″ R. F. 12-3-Pdr. 10-1-Pdr.	2-8″ R. F. 8-4.7″ R. F. 12-3-Pdr. 12-1-Pdr.
Complement	580	477	446	840	600	429	185
Type of boilers	Niclausse.	Scotch.	Scotch.	Belleville.	Belleville.	Scotch.	Scotch.
Type of engine	4 cylinder triple expansion.	Triple expansion.	Triple expansion.	Triple expansion.	Triple expansion.	Triple expansion.	Triple expansion.
Number of screws	2	3	2	2	2	2	2
Fixed weights or weight of hull, boilers and engines in tons	4706	6096	4696	10702	8412	3568	2516
Weight of ordnance in tons	547	230	327		652	400	210
Weight of equipment and outfit in tons	442	420	400		936	250	140
Weight of coal in tons	770	629	153	1000	1000	350	300
Total weight of ordnance, coal, equipment and outfit in tons	1759	1279	880	3498	2588	1000	650
Percentage of weight of ordnance, coal, equipment and outfit to weight of hull, boilers and engines	37.40	20.90	18.70	32.60	23.50	28.20	25.90
Percentage of coal to trial displacement	12.	8.40	2.70	7.00	9.10	7.70	9.60
Percentage of ordnance to trial displacement	8.40	3.10	5.70		5.90	8.80	6.60
Speed	23.25 knots for 12 hours, natural draft.	23.07 knots for 4 hours, forced draft.	21.69 knots for 4 hours, forced draft.	22. knots? for 8 hours? natural draft.	20.72 knots for 8 hours, natural draft.	22.80 knots, measured mile, forced draft.	22.43 knots, measured mile, forced draft.

*Data taken from report of trial board.

COMPARISON OF PROTECTED CRUISERS—TABLE NO. 2.

	Trial trip displacement.	Fixed weights—hull, boilers and engines.	Total weight of ordnance, coal, equipment and outfit.	Percentage of weight of ordnance, coal, equipment and outfit to fixed weights; or weight of hull, boilers and engines.
Variag	6465	4706	1759	37.7
Minneapolis	7375	6096	1279	20.9
Olympia	5586	4696	880	18.7
Blanco Encalada	4568	3568	1000	28.2
25 De Mayo	3166	2516	650	25.9
Diadem	11000	8412	2588	23.5
Terrible	14200	10702	3498	32.6

Mr. Cramp's paper was not of a kind to elicit discussion, but he was warmly congratulated and complimented in behalf of the society by Mr. Lewis Nixon and Secretary Bowles on the performance of the great Russian cruiser.

UNIQUE FORM OF AIR PUMP.

DESCRIPTION AND REPORT OF CAPACITY TEST BY MR. F. MERIAM WHEELER OF THE GEO. F. BLAKE MFG. CO.

At the meeting of this society held in November, 1898, I had the honor of reading a paper entitled "Economy Test of a Unique Form of Feed Pump," in which were given the particulars of a test of a vertical cross-compound feed pump of unusual design. As stated, this test was for the purpose of ascertaining the steam economy, which was quite remarkable, considering the fact that the pump was of small caliber. The present paper, "Capacity Test of a Unique Form of Air Pump," describes a test made to ascertain the capacity of a new design of air pump for surface condensers, and especially intended for marine use. The test was conducted by well-known experts at the works of the Geo. F. Blake Mnfg. Co., East Cambridge, Mass., on Sept. 15, 1899, and was, primarily, for the benefit of the bureau of steam engineering, United States navy, represented by Lieut.-Commander S. H. Leonard, Jr. There were also present Superintending Engineer James S. Doran, representing the International Navigation Co.; Chief Engineer N. P. Towne, representing the Wm. Cramp & Sons Ship & Engine Building Co.; and the writer, representing the builders of the air pump referred to. The air pump tested consisted of a pair of Blake "Simplex" vertical double-acting steam pumps, arranged on the cross-compound plan (see Figs. 1 and 2), the high pressure side having 6-in. diameter steam cylinder, 10-in. diameter air cylinder, 8-in. stroke; and the low pressure side having 9-in. diameter steam cylinder, 10-in. diameter air cylinder, 8-in. stroke. As the steam cylinders were of the same size and design as those of the cross-compound "simplex" feed pump used in the test at Rugby, England, (recorded in my paper referred to), they can safely be credited with equally good steam economy; no attempt, therefore, was made to ascertain the consumption of steam of the air pump described in this paper.

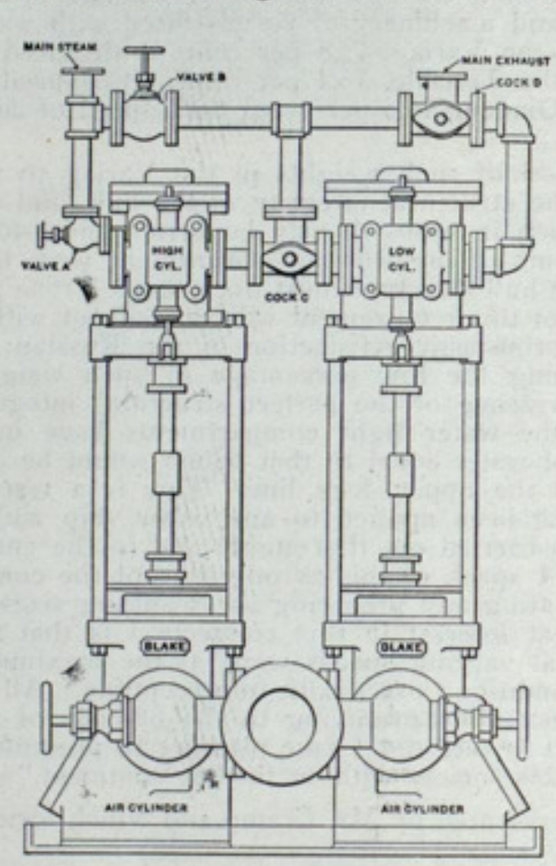


FIG. 1.—THE BLAKE PATENT SIMPLEX CROSS-COMPOUND VERTICAL DOUBLE-ACTING "FEATHERWEIGHT" AIR PUMP. 6" AND 9" x 10" x 8".

ARRANGEMENT OF VALVES

SYSTEM	VALVE A	VALVE B	COCK C	COCK D
TO RUN HIGH AND LOW AS A COMPOUND	OPEN	CLOSED		
TO RUN HIGH PRESSURE SIDE ALONE	OPEN	CLOSED		
TO RUN LOW PRESSURE SIDE ALONE	CLOSED	OPEN		

FIG. 2.

The air cylinders of this air pump were designed on the so-called "suction valveless" principle, each air cylinder being double-acting. The discharge valves for one end of the pump were arranged at the top of the air cylinder immediately over the pump barrel, and the discharge valves for the other end were located at one side of the cylinder casting, as low as they could be properly placed. Both sets of valves were provided with convenient handhole plates. The air piston is a hollow casting of gunmetal bronze filled with a special material of great lightness and water excluding qualities. This piston is sufficiently elongated and alternately covers and uncovers the suction port at each stroke, this suction or inlet port being located at the center of the cylinder. There are, as stated, no suction valves whatever, and the piston has no packing rings of any kind. The cylinder proper is lined with composition bronze, whether the main casting is made of composition or iron. The piston rod, valve seats, valve guards and valve springs are of the same material. The valves are of special construction and made of phosphor bronze. The steam valve mechanism is very simple, and is shown by the sectional view of the pump. (See Fig. 3). It will be seen that the valve rod, so-called, has no valve directly attached to it, as is the usual practice. It merely rotates the auxiliary piston, which latter contains within itself the "auxiliary" valves. This rotating motion is a great advantage, as it frees the auxiliary piston from possibility of sticking for any reason, causing the pump not only to be positive in its action, but securing uniformity of wear. The rolling movement given this auxiliary piston, by means of the "valve rod" and the intermediate swinging pin or tongue, opens and closes the auxiliary ports, which, in turn, control the steam to operate the auxiliary piston, moving said piston back and forth across the main steam cylinder. A plain D-slide valve is attached to this auxiliary piston, which valve supplies steam to the main cylinder through the two sets of ports, namely, the main steam ports and the starting ports, which latter take steam just prior to the former. The steam chest, it will be observed, is placed at right angle to the steam cylinder. By this arrangement of steam chest and valves, a "simplex" pump can work just as well vertically as horizontally.

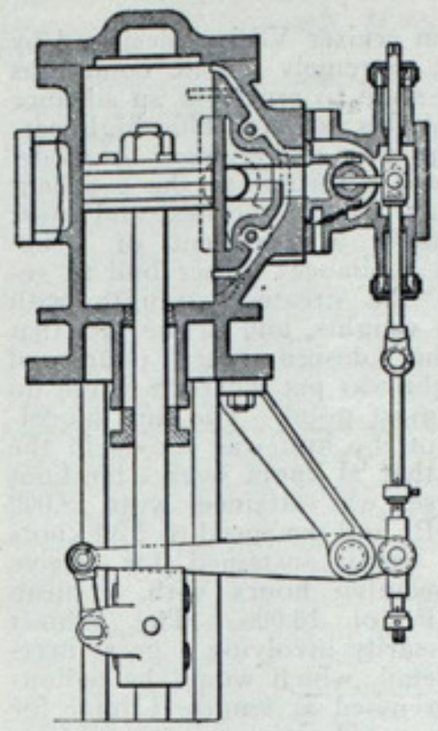


FIG. 3.

An outline cut, showing the general arrangement of the air pump and the piping is shown by Fig. 1, particular attention being called to the manner of opening and closing the globe valve and cocks on the steam, exhaust, suction and discharge connections, in order to operate the pumps conjointly as a compound machine, or separately as two simple air pumps. For condensing the steam a surface condenser was employed with tubes having only screw joints—Wheeler double-tube system—the same being tested to 200 lbs. per square inch, so that there was no suspicion of leakage in the condenser. This surface condenser, besides receiving the exhaust steam from the air pump, took steam from several other steam pumps; and, considering the fact that the exhaust-pipe connections were of a temporary character and not perfectly air-tight, the showing made was quite remarkable. A suitable tank placed on a set of weighing scales was provided for each air cylinder so that a comparison could be made of the efficiency of each cylinder as to the amount of water handled. Several tests were made running the pumps at different speeds (tests Nos. 1, 2, and 3), as a compound machine; then a test was made (test No. 4), on the low-pressure side, and I beg to call your particular attention to the fact that the change from "compound" to "simple" required but 35 seconds of time—so conveniently arranged were the cocks and valves for the purpose. The table below gives the pressure in the steam chest of both the high and low pressure cylinders, and the double strokes per minute for each side of pump; it will be noticed that these strokes were very nearly uniform in number. The vacuum was 27½, 27, and 26¼ in., respectively, for the first three tests, the temperature ranging from 105 to 108 degrees. In test No. 4, when operating the low pressure side of the pump only, and handling at the rate of 36,000 lbs. of water per hour, with 112 F., hot well temperature, the vacuum was 25 in. The amount of water handled as a compound machine was from 26,200 to 60,200 lbs. per hour, according to speed; and it will also be noted that the amount of water pumped was very nearly the same for each air cylinder.

	Number of Test.			
	No. 1.	No. 2.	No. 3.	No. 4.
Steam pressure—high steam cylinder..	70 lbs.	120 lbs.	125 lbs.	.....
Steam pressure—low steam cylinder...	20 lbs.	40 lbs.	45 lbs.	50 lbs.
Vacuum in condenser.....	27½ in.	27 in.	26¼ in.	25 in.
Double strokes per minute—high side..	37	61	82	.....
Double strokes per minute—low side...	35	60	82	88
Temperature of hot well—Fahrenheit..	106 deg.	105 deg.	108 deg.	112 deg.
Water pumped per hour—high side....	13,500 lbs.	22,700 lbs.	30,000 lbs.	.....
Water pumped per hour—low side.....	12,700 lbs.	22,300 lbs.	30,200 lbs.	36,000 lbs.
Total water per hour.....	26,200 lbs.	45,000 lbs.	60,200 lbs.	.....
I. H. P. of high steam cylinder.....	0.60	.....	.....	.....
I. H. P. of low steam cylinder.....	0.58	.....	.....	.....
Total I. H. P.....	1.18	.....	.....	.....

It will be seen by the foregoing that, although this air pump had only 10-in. air cylinders, it gave a capacity, at a fair rate of speed (test No. 2) equal to taking care of an engine, say of the triple expansion marine type, of 2,000 I. H. P. Referring to test No. 3, the pump showed at a higher rate of speed its ability to take care of an engine of 3,000 I. H. P. on a basis of 20 lbs. weight of steam per I. H. P. per hour for said engine. Test No. 1, with the pump averaging a speed of only 36 double strokes per minute, it handled at the rate of 26,200 lbs. of feed water per hour, which, on a basis of 20 lbs. for engine economy, shows the air pump capable of taking care of 1,300 I. H. P. engine at the moderate speed named. Comparing the power of the steam cylinders of the pump (which aggregated only 1.18 I. H. P.) to the I. H. P. of an engine of the power named, shows the pump was doing its work with less than one-eleventh of one per cent. of the I. H. P. of said engine—a decidedly creditable showing for efficiency. Test No. 4 shows the work done by the low-pressure side of the air pump, and it will be noticed that it was able to hold 25 in. of vacuum when handling at the rate of 36,000 lbs. of feed water per hour at a speed of 88 double strokes per minute, the temperature of the water being 112° Fahr. It will therefore be seen that one side of the pump would be able to take care of an engine of 1,800 I. H. P. on a basis of an engine economy of 20 lbs. weight of steam per I. H. P. per hour, with the vacuum named. If the pump was installed for an engine of this horse power, it would hold a high vacuum, say, of 27 in., with both sides of pump in operation as a compound machine, at a speed of about 48 double strokes per minute for each side of pump, on a basis of the work done on test No. 2. In other words, if this pump was used in connection with an 1,800 H. P. engine requiring 36,000 lbs. of feed water per hour, it would hold 27 in. vacuum at a speed of about 60 double strokes per minute on each side, and, if in case of accident or otherwise, one side of the pump was disabled, the other side would take care of the same engine power

by speeding up to about 88 double strokes per minute, but with only 2 in. less vacuum.

The weight of the air pump proper is only 1,290 lbs., and the steam, exhaust, suction and discharge connections 430 lbs. additional. Considering the capacity of the pump this light weight is quite remarkable; in fact, in smaller units, the weight has been reduced still less per unit of power. For instance, the 4 in. by 8 in. by 6 in. vertical "simplex" featherweight air pump on the steam yacht Dreamer only weighs 270 lbs. According to the report of the designers (Messrs. Tams, Lemoine & Crane) the engine of this yacht developed 840 I. H. P. with boilers under natural draft, and 1,245 I. H. P. with forced draft, the air pump holding 27 in. vacuum at a speed not exceeding 103 ft. piston travel per minute. In

SCALE 80 LBS.

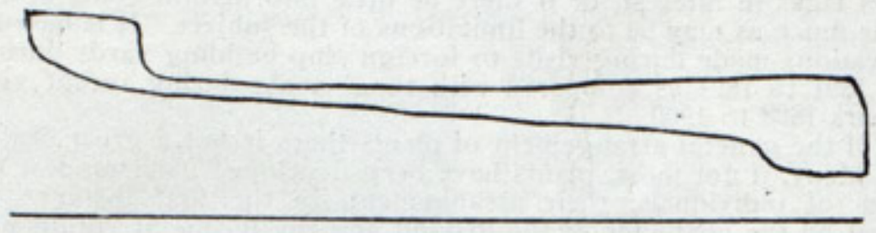


FIG. 4.—FROM HIGH PRESSURE STEAM CYLINDER.

SCALE 50 LBS.

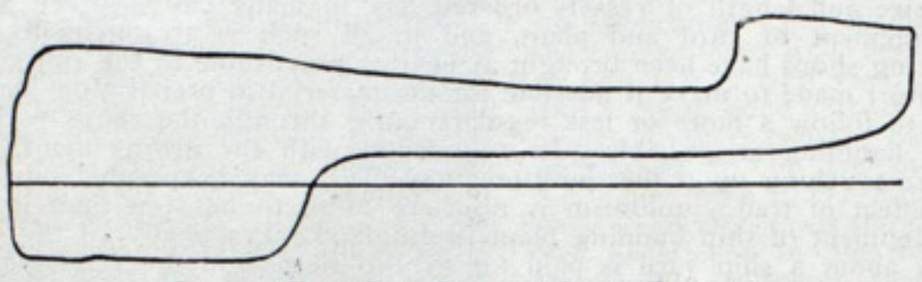


FIG. 5.—FROM LOW PRESSURE STEAM CYLINDER.

SCALE 12 LBS.

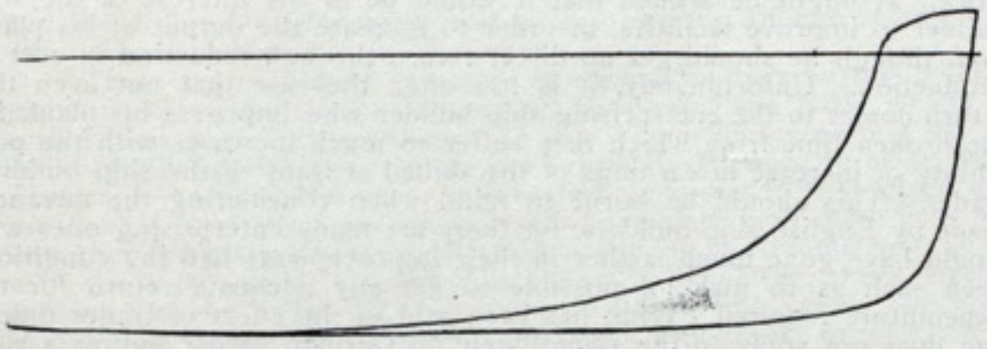


FIG. 6.—FROM AIR CYLINDER.

carrying out the design of these air pumps, minimum lightness (combined with proper strength and rigidity) was kept in mind, and so successful were the results that the writer dubbed his air pump "featherweight," as a handy and significant term when referring to this type of air pump. In addition to the advantages of extreme light weight and compactness, there is great simplicity in the working parts, as will be noticed. Besides the absence of suction valves, such parts as working-beams, rock-shafts, links, cross-heads, etc., are also done away with. Besides the steam economy obtained by the compounding of the steam cylinders, clearance loss is reduced to a minimum by the perfect regulation secured by the "simplex" valve gear; full length of stroke at all speeds can be readily obtained by the simple adjustment of the collars on the valve rod, referred to in the description of the steam cylinders.

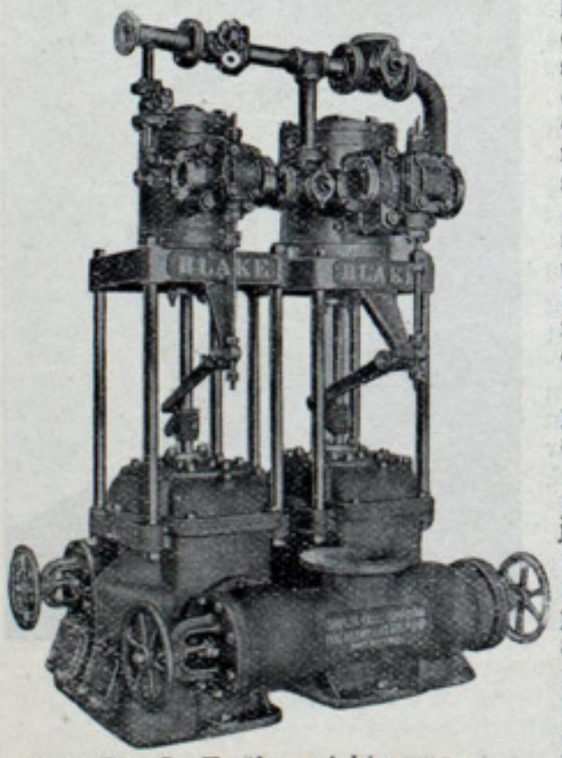


Fig. 7. Featherweight pump.

As there are no valves in the air piston the latter can be allowed to approach the heads of its cylinder as close as 1-16 in. if desired, although I generally advise an adjustment for ⅛ in. clearance. It will therefore be seen how much this feature adds to the value of the pump's efficiency. A single-acting air pump, for instance, would have from 2 to 3 in. clearance space between its bucket and valves to allow for the height of the usual valve bolts and guards. Although the "featherweight" air pumps are double-acting, the flow of water and vapors is always in one continuous direction, the same as in a single-acting pump. This is not true of any double-acting air pump of the ordinary design. Most important of all is the advantage of being able to run either side of pump, should occasion require, the change from running both sides as a compound to running one side as a simple machine can be made in less than half a minute's time—as shown in the above report. This feature practically provides a spare or auxiliary for use in case of accident to one side of pump.

The accompanying cuts (Figs 4, 5 and 6) showing specimen indicator cards taken from the high pressure and low pressure steam cylinders, and from one of the air cylinders, will no doubt be of interest to those who are desirous of studying the action of this type of direct-acting air pump. The air pump card needs no comment, as it speaks for itself, but I would like to explain the peculiar formation of the high and low pressure cards. It will be noticed that the pressure rises at the last part of the stroke. This is due to the fact that the maximum air cylinder load is not reached until the end of the stroke, namely, when the discharge valves are opened. The speed of the pump is somewhat retarded when it meets this load, hence it also explains the lower or exhaust line of both cards. Of course, it is understood this effect is peculiar to a direct-acting air pump, and apparently somewhat against steam economy, but, in view of the fact of the very small amount of horse-power required per unit (sometimes as low as 1-12 of one per cent. of the I. H. P. of the main engine), it will be seen that the net results are very much in favor of this type of independent air pump, especially when the rejected heat in the exhaust steam is utilized for heating the feed water, or is carried to the low pressure receiver of the main engine. An illustration is also appended (Fig. 7) giving a perspective view of these vertical cross-compound "featherweight" air pumps, having a capacity of more than double that of the pump above described. This large pump has an 8-in. high pressure steam cylinder, 12-in. low pressure steam cylinder, and 16-in. air cylinders, the stroke being 12 in. The test of this pump, which took place on March 8, 1900, before Lieut. G. Kaemmerling, U. S. N., representing the bureau of steam engineering; Superintending Engineer S. N. Haines, representing the Oceanic Steamship Co.; Mr. Charles F. Bailey, M. E., representing the Newport News Ship Building & Dry Dock Co.; Mr. Charles B. Edwards, M. E., representing the Fore River Engine Co.; and Mr. J. E. Moulthrop, representing the Edison Electric Illuminating Co. of Boston, showed a capacity and efficiency quite equal to the air pump described in this paper; for instance, this larger air pump handled at the rate of over 115,000 lbs. of water per hour, at the moderate speed of 100 ft. piston travel per minute, holding a vacuum of 27½ in., with a hot well temperature of 100° Fahr. It will therefore be seen from the demonstrations recited in this paper, that a most important advance has been made in the improvement of independent air pumps for marine use, especially in the matter of lightness and high efficiency.

INTERCHANGEABILITY OF UNITS FOR MARINE WORK.

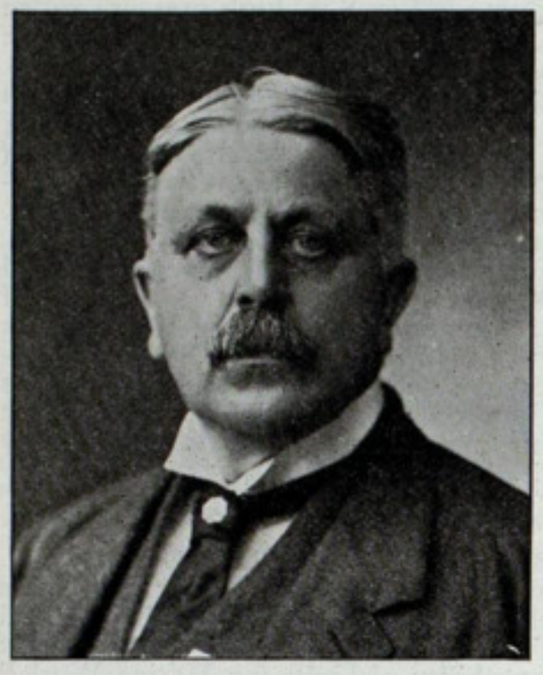
Aside from a few questions asked by Mr. John C. Kafer and Mr. W. I. Babcock in explanation of parts of Mr. Wheeler's paper, there was no discussion. The author was accorded an earnest vote of thanks, and then Mr. W. D. Forbes of W. D. Forbes & Co., Hoboken, builders of engines, read a paper on "Interchangeability of Units for Marine Work." Mr. Forbes said that no country in the world recognizes the great advantage of interchangeable machine parts as does the United States No point so strongly recommends American machinery to the foreign buyer as that of his being able to obtain duplicate parts that actually fit. If duplicate or interchangeable parts are admitted to be of value, why would not interchangeability of units be equally advantageous, especially where the mechanical contrivance is to be used on shipboard, as there the slightest alteration or repair costs out of all reason both in time and money when compared with the same work done on shore? "The navy is in a position," Mr. Forbes said, "to start a system of interchangeability of units in its auxiliary machinery without in any way making it necessary to use a certain make or style of machine, or without inflicting on the manufacturing public any real burden. To illustrate the idea, it is proposed that all generating sets, for instance, whether made by one company or another, of the same K. W. output, shall have the base plate holding down bolts in exactly the same position, and the steam inlets and outlets in exactly the same relative positions in vertical and horizontal planes. It does not seem practical, however, to carry out this idea entirely, but it can at least be approximated so that far less work will be required in substituting one size of mechanical contrivances for others, even if of different makes. It is comparatively little trouble to make changes in piping, as cutting off and threading pipe is not work which demands either great skill or tools which are not to be found on shipboard, and if the holding down bolts or holes are so placed as to need no attention in contemplating or making changes it is evident that the most difficult and annoying part of such work will become simple. In the commercial world time has fairly well fixed certain designs, and to attempt to get the manufacturers to alter their patterns would hardly be successful; yet new designs are constantly being brought out and new patterns are required to replace the old ones, and as the proposed alterations do not affect the essential features of any special make it seems possible to have new patterns and designs meet the demands of the proposed system. The main difficulty is that at the present moment no standard exists. Judging from the conversation which the writer has had with manufacturers there would be little difficulty in getting them to fall in line with any system which would produce interchangeability of units. In some parts of the world interchangeability of entire units is recognized as not only possible but is actually carried out. Small marine engines are so arranged that instead of making repairs in places they are quickly lifted out of the hull, and another engine dropped in and at once coupled up. There is no doubt whatever but what the suggestions of the writer will be looked upon by many as impossible and impracticable; that seems to be the natural tendency on the part of all makers of machinery if any change is suggested; but many members of this society will no doubt be able to recall that when the idea of shafting and pulleys was proposed, and a commercial engineering firm began the manufacture of stock pulleys, almost all the engineers insisted that a hole could not be made in Philadelphia to fit a shaft made in New York; that the demand for pulleys was so varied as to face, bore, etc., etc., that it would be quite impossible to carry on the pulley business. Again, it is not many years since firms began the manufacture of stock gears, and everybody predicted that it would be useless to attempt to help the commercial world in the matter of transmitting power by gear wheels, but today a list of gears is found in every draughting room, and few designers would think of undertaking work without using standard gears."

Mr. Forbes was not mistaken in the expectation that objection would be raised to the radical changes which his paper seemingly proposed. A lively discussion ensued, Messrs. Kafer, Wheeler, Col. Stephens and others taking part. It was the general opinion that all manner of opposition would be found among manufacturers, no matter what scheme might be suggested. But Mr. W. M. McFarland of the Westinghouse companies, who is with Mr. Forbes on a committee of the Society of

Mechanical Engineers that is working along the same line, said this was not so. On the contrary, they had found that where the plan was simply to make progress to the extent that opportunity offered, as in instances cited by Mr. Forbes, the manufacturers were anxious to cooperate. As a result of the discussion, Naval Constructor Linnard moved that a committee of five be appointed to consider the subject and report at the next meeting. The motion carried and the president will appoint the committee later.

PAPERS RELATING TO MODEL TANK, TESTS OF ELECTRIC AUXILIARIES AND MILLER APPARATUS FOR COALING AT SEA.

The paper of Naval Constructor D. W. Taylor on the "United States Experimental Model Basin" was read by Naval Constructor Capps on account of the unavoidable absence of Mr. Taylor. The tank at the Washington navy yard has been several times described in these columns, but of course not at all in a manner approaching the description and elegant illustrations presented by Mr. Taylor. In appendices to the paper Mr. Taylor described the method of preparations of models and the dynamometer apparatus by which their resistance is obtained. It is expected that more will be said of this paper in a future issue. The Washington tank, wholly designed by Mr. Taylor and built under his direction, is such a radical departure and yet so mechanically perfect that Prof. Durand, Mr. King, Mr. Kafer and several of the naval constructors in attendance at the meeting were very earnest in their praises of Mr. Taylor's work.



Prof. A. H. Sabin.

The paper on the "Composition and Classification of Paints and Varnishes," by Prof. A. H. Sabin of Edward Smith & Co., New York, is also one that must be left for future consideration on account of its great length. It is an exhaustive treatise, of especial value to ship builders and ship owners on account of the meager amount of information that has been collected on this subject from a ship standpoint.

Naval Constructor J. J. Woodward announced in arising to read of the "Tests of the Electric Plants of the Battleships Kearsarge and Kentucky," that his was simply a record paper; practically the log sheets of the tests on the Kearsarge and Kentucky. He had promised the society last year on presenting the description of the electric plants of the two battleships (they are alike) that he would submit a description of tests and the record is therefore a continuation of last year's paper. As showing the scope of Mr. Woodward's paper and the extent of electric plants on the Kearsarge and Kentucky, the following contents may be noted: Turret turning gear, boat cranes, deck winches, 13-in. ammunition hoists; 8-in. ammunition hoists, rammers for 13-in. guns, elevators for 13-in. guns, endless chain ammunition hoists, 6-pounder winch ammunition hoists, 50-in. ventilation blowers, No. 6 monogram ventilation exhausters, insulation resistance tests, test of water-tightness, voltage drop, summary of tests of auxiliaries, generating sets, note on wiring calculations and summary of weights of electric plant. The paper was read late in the afternoon of the first day's session and discussion was therefore very short. Mr. James W. Kellogg of the General Electric Co. directed attention to the fact that the tests had borne out all that was said a year ago of the matter of economy in electric auxiliaries.

Mr. Spencer Miller of the Lidgerwood Mnfg. Co. described in a paper read at the last annual meeting his apparatus for coaling vessels at sea. The device was then awaiting trial by the United States navy. His present paper therefore was a supplement to that of a year ago and served to place upon the society's records a fact accomplished, namely, the coaling of the U. S. S. Massachusetts at sea. The apparatus has been described and its successful work in coaling the Massachusetts several times referred to in these columns. Capt. C. J. Train of the Massachusetts was present, and when Mr. Miller concluded reading he told of his displeasure upon learning that the coaling device was to go on his ship. "I thought it strange," Capt. Train said, "that the Massachusetts was selected for the trial of every foolish device brought to the attention of the navy department. But the success of this one was so great that my prejudices were soon changed. It makes coaling at sea a perfectly safe and simple operation." Capt. Train did not, however, agree with Mr. Miller in the suggestion that the device be placed aboard the war ships instead of the colliers. The war ships were already encumbered with too much machinery. Mr. Bowles also said that war ships were already overloaded, but we should have colliers and should have them equipped with the coaling device. Naval Constructor Woodward favored the plan of the government having the coaling machinery on hand so that it might readily be installed on colliers if required.

SHIP BUILDING IN EUROPE AND AMERICA.

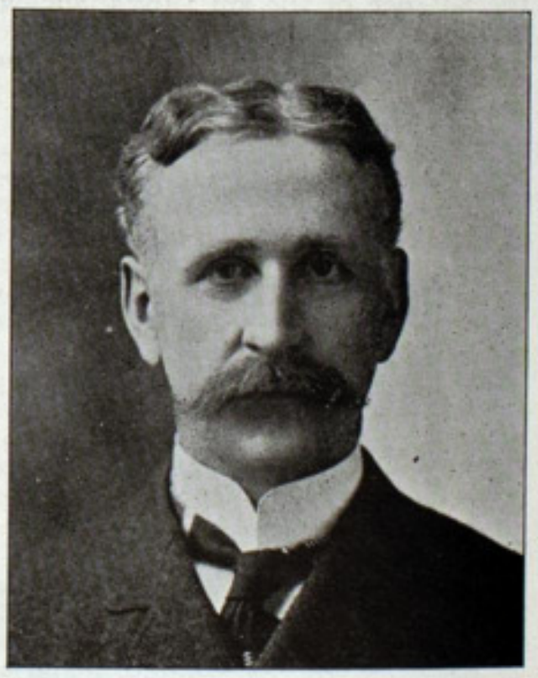
A VERY INTERESTING DISCUSSION OF THE SUBJECT BY THE BUILDERS THEMSELVES—MR. GEO. W. DICKIE OF THE UNION IRON WORKS SUMS UP HIS OBSERVATIONS IN EUROPE.

Mr. Charles H. Cramp presided at the opening of the second day's session of the naval architects. The first two papers on the program for the day related to ship building in Europe and in this country. In his "Notes on Recent Improvements in Foreign Ship Building Plants," Asst. Naval Constructor H. G. Gillmor presented a great deal of valuable information regarding labor conditions, machinery, etc., in foreign yards, but it was the paper of Mr. Geo. W. Dickie of the Union Iron Works dealing with the question "Can the American ship builder under present conditions compete with the British and German ship builders in the production of the largest class of ocean passenger and freight steamships?" that created the most interesting discussion of the meeting. Mr. Gillmor's paper is given first. He said:

"Among foreign ship builders, as among other manufacturers with whom America is in competition, the impression seems to be general that American plants and American tools are as far in advance as those of any country in the world. Having come, unconsciously, to accept this view, it was with some surprise, not unmixed with misgiving as to the possibility of presenting anything worthy of the society's attention, that the secretary's request for a short paper on this subject was received. One ship building plant is, at first sight, very much like another, whether it be in America, in England, or in any other country. It is possible, in ship building, to do with plant of value proportionately so small, as compared with the value of the product output, that often the plant is almost forgotten in the interest in the work being done. If, then, what follows lacks in interest, or if there be little information contained, attribute as much as may be to the limitations of the subject. It is based upon observations made during visits to foreign ship building yards during the years 1891 to 1894 as compared with those made during recent visits in the years 1898 to 1900.

"Of the general arrangement of plants there is not a great deal to be said. Many, if not most, plants have been developed from modest undertakings of individuals, their arrangement, in the first instance, being dictated by the character of the ground and the means at command. In expanding to meet the requirements of increasing business, the best possible, under the circumstances, has doubtless been done; but in few cases is the arrangement the best possible with the given space, nor that which the responsible heads would have made had they been able to lay it out in the beginning on the basis of the present business. The increasing size and length of vessels ordered has, in many cases, forced a rearrangement of yard and plant, and in all such re-arrangements the working shops have been brought as near as practicable to the ships, and an effort made to make it possible for the material in preparation for the ship to follow a more or less regular course through the shops with as little handling as possible. In connection with the arrangement, and before touching upon the question of plant, it may be pointed out that the effect of trades unionism is nowhere more to be seen than in the development of ship building plant in England. Practically all the steel work about a ship yard is paid for by the piece, and the resistance of what is known as the Boiler Makers' Society, a combination of all the iron and steel workers of the ship building and boilermaking trades, to all reductions in piece prices, is so great, and their power is so felt among the ship builders, that it is impracticable to secure any adequate reduction in the cost of labor from improving the facilities for carrying on the work. It might be argued that it would be in the interest of the ship builder to improve facilities, in order to increase the output of his plant, even though he should get no direct return through reduction in cost of production. Unfortunately, it is too often the case that not even this return comes to the enterprising ship builder who improves his plant, for the broken time from which they suffer so much increases with the possibility of increase in earnings of the skilled artisans of the ship building trades. This should be borne in mind when considering the advances made by English ship builders, for there are many enterprising ones who would have gone much farther in their improvements had the conditions been such as to make it possible to get any adequate return for the expenditure required. What has been said of the effect of trades unionism does not apply to the same extent to German yards, and, as a rule, perhaps also partly through their being newer, one finds in them better arrangements and more labor saving appliances.

"There was probably no form of industrial plant more wasteful of power than the average ship building plant of ten or twelve years ago, when, ordinarily, steam was generated in one or more centers in the yard and distributed by a more or less badly kept system of piping, very wasteful at best, and only too often in difficulties. The possibility of an improvement in this direction which could be made to tell directly upon the cost of production has been felt by the foreign ship builders, and among the most important and extensive changes which have been made in most plants in the last decade are those in the direction of improving and increasing the economy and efficiency of power generation and distribution. The most striking feature in what has been done in this direction is the increasing tendency to do away with the steam engine and the piping system necessary to its use. Its place, for many purposes in the ship yard, is being taken by gas or oil engines and by electric motors. There are few foreign yards today in which the gas engine is not to be found doing work which was formerly done by the steam engine; and, in at least one large and important yard, steam has practically disappeared except for the hydraulic pumps and the yard locomotives. The municipal gas companies in nearly all cases supply illuminating gas for fuel and power at a somewhat reduced price. In many cases, however, some form of low grade fuel gas is made on the premises for gas engine consumption. The Dowson and similar processes, by which a fuel gas, made up of hydrogen carbon monoxide and the inert components of air, as produced from coke or anthracite, are generally employed for the purpose. So far as observed the engines used are, for the most part, horizontal single-acting, single-cylinder engines, working at from 120 to 180 revolutions per minute upon what is known as the Otto cycle, giving an impulse for every two revolutions. Their use for driving all the shops, such as the machine and fitting shops, joiner shops, etc., is becoming more and more general, and they may be found applied to almost every purpose in the ship yard to which the steam engine has been applied,



Mr. Spencer Miller.

except for the direct driving of isolated machines. There seems little doubt that the advantages attending the employment of this type of motive power, under the conditions existing abroad, is more than sufficient to justify the outlay which the change in motive power involves. The managers of these yards in which gas engines are most extensively used express themselves as well satisfied with them as mechanical agents. They point out also the very great advantage which they derive from the saving of space by the doing away with steam generators in those cases in which illuminating gas is used, or the relegation of the smaller gas generators used in other cases, to the least valuable and useful space in the yard. In this connection it may be mentioned as a sign of the times that in one important German ship yard a considerable portion of the power of the shops is supplied by a pair of large Diesel oil engines.

"While the gas engine serves very well for many purposes about the ship yard, it is not adapted to the direct driving of the several heavy machines, subject to more or less intermittent working, which have so prominent a place in a ship building plant. In connection, then, with the changes in which the steam engine is supplanted by the gas engine for some purposes, it is not surprising to find its place, for other purposes, being taken by the electric motor. In the general industrial applications of electricity we are, in this country, well in advance of the old world; but in its application as a medium for the transmission and distribution of power in a ship yard, a great deal is being done abroad. Central electrical power stations have been established in, or are projected for, many, both of the larger and more important yards and of those less prominent in the industry. Dynamos of various types and manufacture are employed, though, so far as observed, they were direct-current machines working at about 110 volts. They supply current for both light and power, and are driven both by steam and by gas engines, though steam engine driving is at present the more general.

Asst. Naval Constructor Gillmor.

"There are numerous examples of electric motors having taken the place of steam engines for driving all the heavy and fairly widely separated tools of the plating shops. In many cases motor driving has been satisfactorily applied to machines not originally intended to be so driven. The employment of electricity to this purpose seems to have given entire satisfaction, and there are many yards in which, after trial in a small way, they are extending its application as rapidly as circumstances permit, with the intention of ultimately applying it to all the heavy machines of what may be called the ship builder's side of the yard. The motors have shown themselves capable of working continuously or intermittently for long periods with, at any rate, not more attention than is generally required for steam engines employed for the same purposes, and provided with no other protection from the weather and the dust than a light wooden box or house with end panels of finely perforated tin or iron gauze. It may also be mentioned that it has been found practicable to place the care and management of the wiring and motors in the hands of men, in some cases apprentices just out of their time, whose wage certainly would not entitle them to be designated highly paid specialists. The motors and their treatment would seem, at first sight, rather 'rough and ready,' but they do their work regularly and satisfactorily, and the system has made its way in an industry which is certainly not less conservative than many others. There are few examples of the driving of shop shafting by electric motors. The combination of gas engine driving, when power in large units may be employed as in shop driving with electric motors for the independent driving of isolated machines, or those of large size doing more or less intermittent work, seems to represent the most advanced practice abroad. Hydraulic power is to be found in practically every yard in which vessels of any size are built. It is employed for the heavy flanging machines and manhole presses, and in many cases for operating the smaller cranes used in handling the heavy work at the machines.

"Toward improvement in appliances for handling materials at the ship, with perhaps two notable exceptions, little has been done in recent years. Comment upon this fact usually elicits the reply that it is useless to provide the workmen with facilities which render the handling of plates, etc., at the ship, easier when it is not possible correspondingly to reduce the piece price paid for doing the work. In most cases a series of wooden derricks, distributed along the two sides of the building slips, with a winch each side at the head of the ship, to which whips or purchases may be taken, are regarded as sufficient to meet the requirements. In defense of the system, as compared with other and more elaborate arrangements for handling material, it is also urged that by far the greater number of individual pieces which have to be placed are of such moderate weight that the appliances at present provided are fully capable of doing the work, and that to have a number of such, to all of which work may be brought simultaneously, is preferable to employing some form of traversing crane or derrick. Light locomotive cranes, which may be employed both for handling cars in the yard and for picking up and transporting considerable weights, may be found a part of the equipment of many yards.

"The standard ship yard tools abroad have suffered very little, if any, change in type for years. The increase in scantlings, with the ever increasing sizes of ships, has made an increase in size and power of these machines necessary, and at the same time their speed has been materially improved. The frame bevelling machine, an English invention, while in almost general use in Germany, is used to a much smaller extent in England. A plate joggling machine for joggling edges and butts, and so doing away with liners for the raised strakes, has come into very general use in England. There are also some very ingenious plate scarping machines in use where lapped butts are worked. New and special designs of plate drilling and countersinking machines, rolls, etc., are also fairly numerous. Of the tools of the so-called fitting shops and the joiner shop it may be said that, in a general way, the improved tools adapted to the work of each have been introduced to a moderate extent, and it is gratifying to Americans to find that in these shops many of the newer machine tools are of American manufacture. In many foreign yards a great deal of work, which would otherwise be done in the fitting shops, is let out to concerns making a specialty of that sort of work, so that the fitting shop becomes less important than it would otherwise be. In the employment of portable tools at the ship very little has been done. There are considerable numbers of portable electrical drilling and countersinking machines in use even in some yards in which electricity is not employed for other purposes. Portable hydraulic riveters are also employed to a considerable extent for riveting up frames, floors and longitudinals, generally at the building slip itself. Portable pneumatic tools, however, although used to a considerable extent in boiler shops, have thus far found an extremely limited adoption in the ship yards."

CAN THE AMERICAN SHIP BUILDER UNDER PRESENT CONDITIONS COMPETE WITH THE BRITISH AND GERMAN SHIP BUILDERS IN THE PRODUCTION OF THE LARGEST CLASS OF OCEAN PASSENGER AND FREIGHT STEAMSHIPS?

Mr. Gillmor's paper was so much in line with that of Mr. Dickie that discussion was suspended pending the reading of the latter. Mr. W. M. McFarland, reading for Mr. Dickie, who was unable to attend the meeting, said:

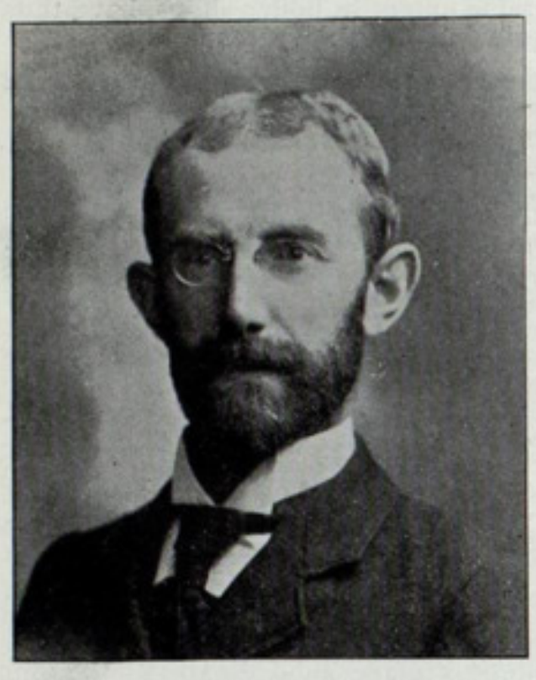
"I am presenting this paper to the society in response to a request received from the secretary before starting out on a trip to Great Britain and Europe, the object of which was partly to note what advantages the ship builders there had over ourselves, either in skill, labor or material, that would enable them to produce these great ocean freight and passenger carriers at less cost, or with greater certainty as to results, than ourselves. This paper is being written on board one of the latest examples of the ship builder's art in that combination of great cargo capacity and a moderate amount of very comfortable passenger accommodation, combined with a speed that was considered fast not so many years ago. The steamship Saxonia, on which I am writing this paper, is the embodiment, I think, of a higher type of skill in naval architecture than those vessels wherein everything is made subordinate to the one sought-for quality of speed. This type of ship will, I believe, become the most important in the future extension of American shipping. Here is a vessel that carries 9,000 tons of freight at 15½ knots on a coal consumption of 145 tons per day, or 1,200 tons of fuel used to carry 9,000 tons of cargo across the Atlantic, and at a speed that secures a large passenger patronage. Now the secret of obtaining this result is, first, the great increase in the size of ship, and, second, fitting engines of just the size required for the speed. The old idea of having a large surplus of engine and boiler power that the owner can never afford to run at its full capacity is a thing of the past, and ships are now designed with just sufficient power to meet the conditions as required by the trade in which they are to engage. Increased efficiency of engines and boilers has also helped in this astonishing result.

"The question that forms the subject of this paper is one that has ever been present to my mind while visiting British yards and talking with British ship builders, and in trying to find an answer I have endeavored to compare ourselves with them in the three factors that enter into production—skill in design, cost of labor and cost of material. In regard to skill I have always found it difficult to make any just comparison between the product of one ship builder and another, the term meaning different things to different people. Skill in design must in merchant work have the commercial element as a prominent factor, and must embrace both the financial interests of the ship builder and the ship owner, and in order to prevent these interests from injuriously affecting the interests of the shipper who entrusts his property on the vessel, and the interests of the underwriter who insures the interests of the ship owner and merchant, certain societies representing all the interests involved hedge the designer about with rules that give him but a very narrow field in which to exercise his skill as a naval architect. Yet, narrow as this field is, the progressive ship builders of Europe are continually pushing out the barriers and forcing the recognition, by the registration societies, of new methods in construction, new properties that experience has shown to be desirable, and new combinations that have transformed within the past few years, not only the dimensions of the ships built, but the whole method of construction. So that, hampered on every side as the naval architect is, by rules and traditions, his skill has been ever on the alert for the smallest opportunity to push out still farther the barriers set up against him. In thus stating the obstacles that oppose the exercise of the naval architect's skill in design, I do not set these obstacles down as opposed to progress, but as limitations to the free exercise of the skill in design that many naval architects, and especially those of America, think they possess. When the ambitious young naval architect studies the rules, say of Lloyd's Register of British and Foreign Shipping, his first impression is that those people who make and maintain these rules are opposed to all progress, and imagine that they and the rules they have made represent the consummation of all that is possible in ship building. As he gains experience, however, in his work, this first impression of his will be modified. I have lately had to discuss with the chief surveyors at Lloyd's certain departures, that we considered slight

Mr. James Dickie.

and in the line of improvement, from the rules as applied to two large freight twin screw steamers we are now building. I have found that the skill of the experts at Lloyd's, and the careful study of every proposition made to them, not only protects all parties, but insures a steady forward movement, consistent with the proper protection of all the interests involved. I believe, however, that an American register of shipping that would be accepted by the ship owner and by underwriters the world over, would be a great help to the American ship builder, as it would no doubt lend itself more readily to the tendencies of American design. The British ship is the result of British experience, gained by British ship owners and sailors, embodied in British designs by the British naval architect, finally taking form in British ship yards; the result carrying with it much of the traditions and practice of the people and place where the work is done.

"Now can we in America do better than this? We are very likely to do a little different, as much different probably as the limitations referred to will allow, and these differences will, I think, take the form of a closer adaptation of the material used to its place and function in the complete design. In this the steel manufacturer will likely take a share. As he becomes better acquainted with the special needs of ship construction, we will find him ready to undertake new sections better adapted to take the strains and stresses of ship structure, and reducing built up work to a minimum. We are on this point now abreast of the British builder, and, in methods of handling, ahead of most of them. In skill I think the American naval architect is quite abreast of his British cousin, and if he has plenty of practice there need be no fear of him keeping in that position. In some of the great ship yards of Britain and Europe they have acquired a greater experience in the production of the largest ocean steamships, both for passengers and freight, than we have; but we are in the way of obtaining this experience, and it will come to us just as it came to them, by a steady and skillful application of what we now have. I find also, especially among the younger naval architects in Britain, an opinion they are ready enough to express, that the United States is to be in the near future a rich field for the practice of their profession. I have found this opinion naturally strongest among those who feel the limiting power of British ship building traditions strongest. Such men, if they come to our side, will have an effect in moulding what may become American traditions in the future history of the art.



Mr. Theodore Lucas.

LABOR COST IN BRITAIN AND THE UNITED STATES.

"Granting, therefore, that there is nothing lacking in skill on the part of our designers, how are we in regard to the second factor in the problem of competition—that of the cost of labor? This is the one factor that presents the greatest difficulty in dealing with the problem of relative cost as between the ship yards of Great Britain and those of America. We work under different conditions in regard to a large portion of the work. The whole steel work of a ship may be said to be done under the piece work system in Britain, the price per unit being fixed for certain ship building districts between the ship builders and the unions representing the men. This method has its advantages, as it simplifies the estimating—a certain known portion of the work having a certain fixed value. While a considerable portion of the work with us is done on some piece work system, every yard appears to have its own way of fixing prices with the men. In the British yards, as with us, while practically all the steel work is done under some kind of piece system, yet on inquiry it appears that it is with them very much as it is with us; the number of men on wages on the very work supposed to be done by piece is greater than that of the piece workers, and skill in management is directed to the reduction of the number of men on wages as compared to the number on piece work.

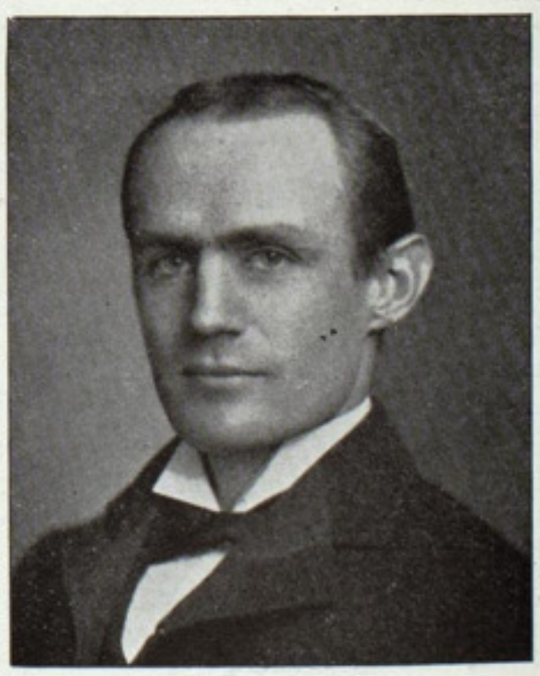
"From combining what information I have been able to gather, I find that on an average the steel work of construction cost in the British yards from £3 17s. to £4 per ton of material worked. This, I think, we can about equal in labor cost here. But when it comes to fitting out, including carpenter and joiner work, painting and general finish, where piece work does not cut any figure, the cost, I think, is directly as the wages paid. We employ the same class of men as they do; in fact, our best men come from the British yards, and while in some of our yards we may have some advantages in climate, this does not apply to all, and where we are paying 50 per cent. more wages, the cost of labor that is reckoned in wages will be 50 per cent. more here than it is in the British yard. And if half the labor cost for any given ship built in a British yard is paid in wages—and this is very nearly correct—and that half costs 50 per cent. less than the corresponding part in our yards, our total labor cost will be 25 per cent. greater than theirs. This is very nearly correct, as tested by comparisons I have been able to make of actual costs as between our yard and one or two in Britain, where I have been furnished with labor costs. I am convinced, however, that although we pay higher wages to our office staff of draughtsmen, that part of the work does not cost any more than in the British yards, as we seem to be able to do a like quantity of work with a smaller force. The managing staff in our yards are, I think, paid less than corresponding officers in the large yards there, and they devote much more time to their duties.

"As to what we may be able to do in regard to equalizing the cost of labor as between our yards and those of Great Britain, I do not think that it will be brought about by any attempt to equalize the rate of wages paid throughout the ship building world, but I have hopes that some of our rising ship builders among the younger members of our profession may be able to devise some method whereby every part of a ship, both hull and machinery, will have a labor value fixed for it that will not exceed what such a piece of labor costs elsewhere, and that whoever, by his labor, contributes to the production of that piece shall receive as recompense his portion; that is, the percentage that his labor represents in the total labor required to complete the part on which he worked. Something of this kind must be the foundation on which any true settlement of labor values must rest, and as it is done now with eminently satisfactory results in some of the most prosperous machine manufacturing establishments in England, it only needs the right kind of skill, honestly applied, to make it work in ship building and engineering establishments in this country. I am so impressed with this, to me the only just way of recompensing labor, that were I twenty years younger I should take it up as a life work.

QUESTION OF ENGINE AND BOILER COSTS.

"I find that the marine engine and its boilers cost less in proportion to the hulls than they do with us. This is no doubt due to the fact that neither there nor here does piece work prevail in the production of the marine engine or its boilers, while machinists and boilermakers receive at least 50 per cent. more wages with us. In small tools I think we are better equipped than the engine works attached to the large ship yards there, but in heavy tools we are not better off than they are. Some prominent engine builders in this country seem to be able to compete with engine builders in Great Britain, sending their engines to the very centers of engine building in that country, and, so far as we know, with profit to themselves. At least they continue doing it, which would indicate that it is profitable. If this can be done with land engines it can also be done with marine engines, but not on present methods. We must be content without the professional luxury of introducing some engineering novelty with every ship we engine. I do not say that we should be satisfied without making substantial progress in marine engineering, but healthy progress is not inconsistent with a standard system of working that would greatly reduce the labor cost of producing a modern marine engine.

"In a large and prosperous engine works that I visited in England, building a special type of engine, but in all sizes from 10 to 3,000 H. P., I found that the term erection was not used. Every part of their engine is made to gauge, and when finished from the tools is sent to an expert examiner at a large surface table, with accurate measuring instruments, whose business it is to determine if every operation performed by the tools on that piece has been accurately done; that every hole has been bored properly; that every face is in its proper plane. He signs the workman's card that did the work if it has been done correctly; if not, the work is returned to him for correction, or rejected if it cannot be corrected. Every piece of work has a fixed labor value. Every man gets his regular wages. If the work he produces exceeds in labor value the wages, he is credited with 50 per cent. of the difference. If the labor value of his work is continually less than the wages paid him he cannot continue to work in that establishment. The pieces thus produced that go to make an engine when brought together are not erected as we do, fitting each piece to its place by file or chisel, as may be, owing to defective tooling; but they are placed in stock ready to be assembled in a few hours on receipt of an order for an engine of the size they represent. A system to insure correct tooling on every piece entering into the construction of our marine engines would, in my opinion, reduce the cost of erection by one-half. Some such system, and making every man a partner, so far as the result of his own labor is concerned, would place us in marine engineering where we are now in the production of land engines. If we are to pursue the same methods as we are now doing, which are just the same as those that prevail in the ship building and marine engineering centers of Great Britain and Europe, our labor costs will be very nearly in proportion to the wages of rates as compared with theirs. But in the development of some plan whereby we can fix a labor value for all our work that will not exceed theirs lies our salvation, and the American workman would, in my opinion, profit largely by the general adoption of some such plan.



Mr. Harrison S. Taft.

"On our present methods our labor cost is, as near as I can compute it, 25 per cent. greater on the hull and 50 per cent. greater on the machinery of an average ocean going freight and passenger steamer. I trust this statement will be carefully discussed by any member of this society who has any knowledge on this question of labor costs, for much of our future progress in ship building depends upon how we are able to solve it.

COSTS OF MATERIAL.

"Now in regard to the cost of material: I am afraid that this part of my subject is beyond my ability to in any satisfactory way compare our conditions with those of the British or European ship builder. The most important material affecting the cost of ship building is steel, and the tremendous fluctuations that at times take place in the price of that material in this country is the most serious question we have to contend with in trying to predict anything in regard to the future of ship building. The tariff on steel plates and shapes makes it possible for us to find the British ship builder working into his ships American steel from Pittsburg at a less cost to him than the English material, and at less cost than is charged the American ship builder for the same material in Pittsburg. I saw in a yard on the east coast of Scotland steel being worked into a vessel that was delivered in the yard from Pittsburg at less than £7 2s. 6d. per long ton. If the American steel manufacturer can meet the British steel manufacturer on equal terms in the British ship yards, somehow it seems as if it might be possible for the American ship builder to get his steel material as cheap as the British ship builder gets his. This is all that I possibly can advance on this part of my subject.

As the duty on steel of this character is not a protective measure, and cannot possibly produce revenue, it should not be maintained to render wild fluctuations in price possible. I may be wrong, however, as to the cause of the immense variations in the price of steel here, but I think I am right in saying that such conditions relative to the most important material he uses are a great obstacle to the progress of the ship builder in this country. Engine and other forgings cost more with us than they do in Britain and Europe. In ordinary forgings of steel this difference is from 30 to 50 per cent., and in high grade forgings, such as required by our navy department specifications, there is no comparison. The usual extra charge for nickel steel forgings in Britain is £4 per ton extra for each 1 per cent. of nickel in the steel. I did not find nickel steel forgings being used at all in merchant work.

"On the whole, I think the British builder has an advantage over the American builder in the cost of material. This applies even to the wood used. As near as I can judge at the present time there is 10 per cent. in cost of material in favor of the British ship builder as compared with the cost of material in American yards.

"From the foregoing, if the statements I have made are correct, we are not yet in a position to compete with the ship builders of Britain or Europe, Europe meaning Germany only I think, in this connection, the difference being not less than 15 per cent. on the finished ship. As we gain experience and adopt new methods, especially in regard to the management of that most important factor, labor, this difference may ultimately disappear. Some wise legislation will have to be devised that will enable the American ship owner to build his ships here, although costing somewhat more, until we have found out the way to pay American labor to build American ships that will not cost more than the British ship built by British labor. I am conscious of the fact that, although I have tried to place this subject fairly before the society, I have failed to present it in any new light. Somehow it belongs to that class of subjects that cannot be demonstrated by any statement of facts, as facts in one place are not facts in another, and facts today are not facts tomorrow. I am afraid that we must hope for more than we can at present see. Perhaps the subject touches too closely the business interests of those of our members best qualified to discuss it, and on that account we may not get as free a discussion of it as would otherwise be the case. Yet its importance should command the interest of our members and lead them to place before the society their thoughts on the questions I have tried to answer in a negative sort of way."

FROM THE CLASSIFICATION REGISTER POINT OF VIEW.

Mr. E. Platt Stratton had prepared, from the standpoint of the ship classification interests, which he represents, a few remarks regarding that part of Mr. Dickie's paper which refers to the classification societies. Mr. Stratton said:

"As members of this society we have occasion to thank Mr. Dickie for his excellent paper, bearing as it does so directly upon the impressions and observations of an eminent expert and ship builder when among the European yards. He also gives consideration to the classification branch of our business as applied to ship design and construction by stating that 'in merchant work the commercial element is a prominent factor, and in order to prevent these interests from injuriously affecting the interests of the underwriters, who insure the interest of the owner and merchant, certain societies representing all interests involved hedge the designer about with rules that give him but a narrow field in which to exercise his skill.' Our contributor in this paper covers the field of ship classification and its effects as applied to merchant shipping in a very few words, but with a breadth of vision that is seldom, if ever, met with outside of those financially interested or directly engaged in the commercial management of ships, for few people appreciate the fact that the value of the cargo a ship carries annually is always far in excess of the value of the ship itself, for on the average cargoes of commercial steam vessels change from two to three times in every month of the year, and such cargoes, exclusive of coal and low grade ores, will equal from two to three times the value of the ship carrying them. Hence it is that the insurable value carried by a vessel ranges from fifty to seventy-five times the value of the ship in a single year. Mr. Dickie's paper fully appreciates the true financial importance of this condition, which applies alike to all merchant shipping, for such conditions of finance and commerce cause the merchant, banker and insurer to stipulate or control their financial transaction in a greater or less degree by the certified character of the construction of the ship that seeks commercial employment through their influence or capital, rather than be guided by the reputation of the builders, owners or designers. And so it happens that underwriters, bankers and merchants demand the rating and classification of ships by organizations that have no pecuniary interest, either direct or implied, in the vessels themselves, or the transactions in which they become a factor. The real parties in interest require something more independent and defined than a builders' guarantee, which becomes more and more remote as the age of a ship advances, and virtually ceases to be a factor at all when you consider the conditions incident to use, abuse and neglect, which all vessels are more or less subjected to. A vessel's character therefore properly becomes a question or matter that rests solely between her owners and the underwriters. Hence it is that 'a certificate of a classification society when once issued becomes the builders' receipt, the banker's or owner's guarantee, the underwriter's authority and the shipper's business guide.' These conditions of the unwritten law of banking, commerce and insurance tend to cause some of us, who may be experienced in such matters, to think, or believe, that it is possible for an American classification society to quickly become an institution greater than the extent of the commerce of the country it represents or the financial and mercantile interest it is employed to foster and protect. But such is not the case since a classification society can only be measured by the percentage of sea-going commerce it classifies of the country or nation it represents. The thanks of this society are due to Mr. Dickie for this interesting contribution to our literature, and I move you that they be so extended to him and spread upon the minutes of our meeting."

MR. BABCOCK DIFFERS WITH MR. DICKIE.

Mr. W. I. Babcock, who was very prominently connected with ship building on the great lakes until the consolidation of the different steel yards in the lake region, had also prepared remarks bearing upon Mr. Dickie's paper. He said: "In taking issue as I am with the conclusions that Mr. Dickie has reached in his most timely and important paper, I approach the subject with much diffidence, as my own opinions are based, as far as actual facts regarding costs are concerned, on an experience which for many years has been entirely on the great lakes, and with the building of a class of ships differing in many respects from the type referred to in the paper, and to which its conclusions are meant to apply. As to skill in design, little need be said. It would be a bold man who before this distinguished gathering of the fraternity would admit for a moment that America was lacking in that respect. From the days when the Constitution outsailed the whole British fleet down through the time when the American clipper ship was the acknowledged queen of the seas to the present day, when the American cup is still with us and the Variag holds the steaming record, the American designer has been at the head of the list, and no one doubts but that he will remain there, no matter what new responsibilities arise. The nation that beats us in that respect must beat the man who built the Oregon. Mr. Dickie's opinion that at the present time the British builder has an advantage of about 10 per cent. over us in the cost of material, I shall not attempt to dispute. He knows a great deal more about it than I do. In the long run, however, it seems absurd to suppose that this advantage can continue, and it seems to me that not only can it be neglected now, but that we can safely count on the difference being the other way in the very near future. There remains only the cost of the labor and that is by far the most important of all. I must admit that I do not quite follow Mr. Dickie's figures here. He says that our total labor cost on a ship is 25 per cent. more than the British cost, and also that the labor cost of the steel work of construction alone is about the same in both countries. With this latter statement I agree, for I arrived at the same conclusion from such information as I was able to obtain when over there three years ago. On the lakes the labor on the steel work alone of a ship is about 32 per cent. of the total cost of that ship, and all other labor, painting, carpenter and joiner work, outfit (excluding propelling machinery) ranges from 7 per cent. in a bulk freighter to 12 per cent. in a package freight steamer, the latter meaning a boat with main deck, gangways and hoisting machinery, and the former an ore, coal or grain carrier. Now, if the labor cost on the steel work is the same in both countries, it is impossible that an addition of even 50 per cent. to the cost of the other labor, which in any ship would be considerably less than that on the steel work, though perhaps not as much so as on the lakes, could add 25 per cent. to the total labor. Mr. Dickie seems to think that the explanation of the equal costs on steel work lies in the piece work system. But his own statement is that even on work supposed to be done by piece, there is more day work than piece work. How then does he account for equal costs, even supposing piece rates the same, when our day wages are so much greater? Fifty per cent. he gives it, though I think it is nearly 75 per cent. It seems to me that the true explanation is that our men do much more work in a day; that they are very much steadier and lose a great deal less time; that they are not throttled and held down by the restrictions of labor unions; that the working day is better divided up in two periods here instead of three, as on the other side; that our yards are better arranged, have better machinery and our management is better. Now if we can overcome the handicap in wages in steel work, why can we not do the same in everything else? We can; and all we want is work enough to keep our yards occupied all the time and a little more experience to prove it."

Other members participating in the discussion—and there were many of them—were as a rule opposed to the piece work system, but agreed that the American workman gives greater output per hour. Various reasons were assigned for the difference in costs on the other side of the Atlantic, and some advantages which we possess, especially in labor-saving machinery, were pointed out. It was the final consensus of opinion, however, as expressed by Mr. Lewis Nixon, that when we have 1,400,000 to 1,800,000 tons of merchant ships to build in a year then we can compete with Great Britain. It is simply a question of demand. We can not compete with the British while we have such a condition as a ship yard working along on a ferry boat, a tug, a battleship and a revenue cutter all at one time. This condition Mr. Nixon had actually witnessed recently at a yard on the coast.

WRANGLE BETWEEN REPRESENTATIVES OF RIVAL CLASSIFICATION BUREAUS—PAPERS READ AT THE FINAL SESSION.

At the final session on Friday afternoon the paper of Mr. Theodore Lucas on "Classification Rules" stirred up considerable unpleasantness between the representatives of rival ship classification societies. Mr. E. Platt Stratton, representing the Record of American and Foreign Shipping, read a lengthy reply to Mr. Lucas, in which he charged that gentleman with wilfully misrepresenting the methods and rules under which the Record of American and Foreign Shipping is published. Mr. Stratton's remarks were decidedly of a personal kind. Sinclair Stuart, representing the British Corporation, also took a hand in the controversy, showing the ill feeling that has existed for a great many years between the New York representatives of rival registers. It was a variation from the mild manner of discussion during the earlier sessions. Mr. Charles H. Cramp questioned some of Mr. Lucas' statements, but the members otherwise did not mix up in the matter, as they were evidently satisfied from what they heard and from past experience that the register branch of shipping interests will bear improvement if it is to keep pace with the upbuilding of our merchant marine. It was finally agreed that all personal matter in the controversy should be eliminated from the proceedings.

Mr. Harrison S. Taft's paper on "A Comparison of the Contract Prices of Our Naval Vessels" led Mr. Nixon into a discussion of the real costs of building naval vessels and the disadvantages of the navy department designing vessels that can not be built within the appropriations. He was especially severe in his criticism of the growing practice of loading naval vessels up with all manner of complicated machinery. His reference to contract prices and real costs would leave the impression that he did not look with favor upon Mr. Taft's paper, but it was explained that Mr. Taft had merely made up a comparison of the official record.

The paper of Chief Constructor Philip Hichborn on "Recent Designs of Battleships and Cruisers for the United States Navy" was of the kind usually contributed from the chief constructor's office—authoritative data concerning the continued development of our navy. The

paper was simply one of plans and description, with no attempt to enter upon a discussion of the merits of the designs.

The two final papers, "Launch of a Cruiser and a Battleship," by Mr. James Dickie of the Union Iron Works, and "The Safety of Torpedo Boats at Sea and in Action Under Various Conditions," by Naval Constructor Lloyd Bankson, had to be read by title only.

BANQUET AND VISIT TO THE CRAMP SHIP YARD.

Mr. Clement A. Griscom, president of the Society of Naval Architects and Marine Engineers, was toastmaster at the banquet, held at Delmonico's Friday evening. About 150 members of the society and their friends were present. At the guests' table were Charles H. Haswell, Charles H. Cramp, Congressman Amos J. Cummings, Lewis Nixon, Charles J. Loring, Col. J. J. McCook, Stevenson Taylor, Naval Constructor F. T. Bowles, John C. Kafer, W. M. McFarland, Naval Constructor Wm. J. Baxter, Col. A. L. Snowden and Naval Constructor W. L. Capps.

Congressman Cummings was introduced as the first speaker. In responding to the toast "The Navy" Mr. Cummings said: "I have been asked to speak for the navy. The American navy speaks for itself. It has always been a factor in civilization. It is the arbiter in wars between coastwise nations." Mr. Cummings gave a detailed history of the different engagements in which the navy has taken part and showed that it was the navy that the country could thank for coming to the rescue of the nation's honor. Mr. Cummings said he thought that some kind of a bill for the establishment of a competent naval reserve would be taken up in the next session of congress. "Our success in naval wars," he said, "has made the European nations quiver. They ask what might happen if this country should develop her navy to the same extent as England. For my part, I shall always favor the increasing of the navy. I believe that the more battleships we can get in the next ten years the better."

Col. A. L. Snowden followed Mr. Cummings. He advocated not only the increasing of the navy, but the increasing of the number of American merchantmen. "Why is it that we do not see the flag on more vessels in foreign ports? The condition of the world's business has changed but we have not changed with them. We must apply business methods of the world or go out of business altogether. We must go after the world's business. It surely will not come to us. I do not favor increase of the navy for the purpose of conquest and blood, but for the advancement of commerce and humanity."

Col. J. J. McCook also spoke in favor of increasing the marine service of the country. He said that no country in the world could cope with us in the matter of getting the raw material for building ships and the brains to build them with, and that there was no reason why we should not excel the world in the industry.

Mr. Nixon followed Col. McCook. He eulogized Mr. Charles H. Cramp as the leader of the ship building industry of the country. He then spoke of the gradual increase of ship building in this country, and said that it would continue to grow.

Other speeches were made by C. H. Loring, Stevenson Taylor, W. M. McFarland and W. L. Capps. Senator Chauncey M. Depew was to have been present and make an address, but he was unavoidably detained.

VISIT TO THE CRAMP SHIP YARD.

Mr. Charles H. Cramp had invited the society, previous to the meeting in New York, to visit the Cramp ship yard at Philadelphia on Saturday. Most of the members of the society in attendance at the meeting took advantage of the invitation. A special train was provided over the Pennsylvania railroad. The different points of interest in the Philadelphia yard, where 6,000 to 7,000 men have been employed for some time past, were visited. The Cramp works are certainly very busy at this time. Hundreds of men were employed on the Russian cruiser Variag, making repairs to the machinery damaged on trial and giving her final touches before she is turned over to the Russian officials. The Russian battleship, launched some time ago, was also viewed with considerable interest. The Venturia, last of the three large Spreckles freighters, built for service between the Pacific coast and Australia, was at one of the docks and seemed almost ready for departure, but will not get away for a few weeks yet. The American liner St. Paul, with wrecked machinery, has just arrived at the yard for repairs. On the stocks in the main yard were the battleship Maine, two large steamers for the New York & Cuba Mail Line, just put down, and two more, well along towards the launching stage, for the Clyde line. In the extension of the ship yard, recently acquired, it was found that considerable progress had been made with the two new American liners.

A sumptuous luncheon was served to the visitors in the mold loft just previous to departure for their homes.

HIS FOUR HUNDREDTH AND LAST TRIP.

Capt. Heinrich Christoffers of the North German Lloyd steamship Trave is now on the ocean, bound for Bremen, on his four hundredth and last trip across the ocean. His wife accompanies him on his last voyage, a hard and fast rule of the line being waived for once. He has served the North German Lloyd Co. continuously for thirty years. His father and grandfather were seamen before him. When he was 16 years old he went to sea for the first time as cabin boy on the German brigantine Germania to the Black sea, during the Crimean war. He served on sailing ships until 1870, when he entered the service of the North German Lloyd line as the fourth officer of the steamship Hermann.

Hunters' Rates—From Nov. 9 to Nov. 30 the Nickel Plate road will sell excursion tickets to hunting parties of three or more traveling together on one ticket at one fare for the round trip. Return limit Dec. 2. There are immense quantities of small game along the line of the Nickel Plate road in western Ohio and Indiana. Write, wire, 'phone or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O. 247 Nov. 30.

"We have protected everything except our shipping and now it seems to me the time has come to protect that."—Senator Scott of West Virginia.

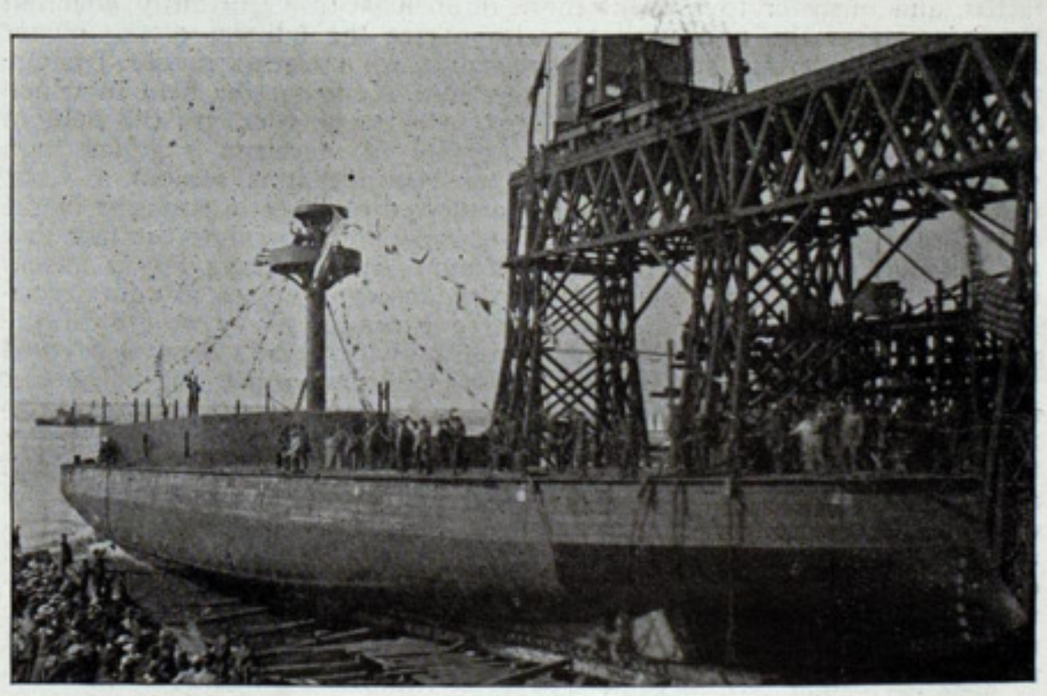
REPORT OF THE NAVIGATION COMMISSIONER.

The report of Mr. E. T. Chamberlain, United States commissioner of navigation, just issued from the office of the commissioner in Washington, says the past fiscal year has been the most prosperous period known to American shipping for some years. Returns for the current fiscal year promise an even more satisfactory record. For the first time since the civil war the documented tonnage of the United States exceeds 5,000,000 gross tons. On June 30, 1900, American documented tonnage comprised 23,333 vessels of 5,164,839 gross tons, an increase of 300,000 tons over the previous fiscal year. Our maximum tonnage was 5,539,813 tons in 1861. Our shipping, the report adds, in 1861 was larger than Great Britain's and nearly equaled the British empire's. British shipping now amounts to 14,261,000 gross tons. American vessels are almost wholly confined to the coasting trade, which employed last year 4,338,145 tons, or more than the total tonnage for Germany and France. Our tonnage in the foreign trade was only 816,795 tons, and carried last year only 9 per cent. of our exports and imports. A century ago American shipping registered for foreign trade was 669,921 tons, while this tonnage now in the thirteen original states amounts to 482,907 tons.

The report says that for serious competition with foreign nations in the ocean carrying trade we are practically restricted to ninety-seven registered steamships of over 1,000 tons, aggregating 260,325 tons. Single foreign steamship corporations own greater tonnage. Japan has eighty-three ocean steamships of over 2,000 tons, aggregating 286,000 tons. Besides these steamships we have 125 registered square rigged sail vessels, over 1,000 tons each, for the deep sea trade. More than half of these are over twenty years old, and as such vessels disappear their places are not supplied by new construction.

Our tonnage is distributed between the Atlantic and gulf coasts, 2,727,892 gross tons; great lakes, 1,565,587 tons; Pacific coast, including Hawaii, 612,904 tons; Mississippi and tributary rivers, 258,456 tons. Our steam vessels amount to 2,657,797 tons, documented canal boats and barges to 622,000 tons, and the remainder, 1,884,842 tons, are sail vessels and schooner barges. The increase in our shipping during the decade was 740,342 tons, of which 502,523 tons stand to the credit of the great lakes. The increase in ten years on the Pacific has been 184,512 tons, due mainly to Alaskan and Hawaiian trade, and on the Atlantic and gulf coasts only 89,297 tons, while the tonnage on the Mississippi and tributaries has decreased 36,000 tons.

On Aug. 15, 1900, sixty-eight merchant steel steam vessels aggregating 278,000 tons, and forty-seven naval vessels, 113,000 tons displacement, were building or contracted for in the United States. Contracts since that date bring the merchant total up to 350,000 tons, including about 100,000 tons on the lakes. Congress has authorized 179,800 tons (displacement) of naval vessels, not yet contracted for. Part of the merchant construction will not be completed in two years more, but the current year will record much the largest amount of steel ship building in our history.



Launch of the U. S Monitor Arkansas at Newport News, Va.

Three other similar vessels, harbor defense monitors, first of their kind since the civil war, are also under construction.

PREDICTS GREAT SHIP BUILDING DEVELOPMENT.

Discussing the fact that his company has lately given contracts for two large steamships to the Maryland Steel Co., Sparrow's Point, Md., President B. N. Baker of the Atlantic Transport line said: "This is only a beginning of what we propose to do. Heretofore the ships of this line have been built in England and at Belfast, Ireland, where Harland & Wolff's plant is located. I am an American and I would prefer to have ships built on this side, even if the cost of construction is greater. The Republican platform promises that the Republican party will in its legislation pass measures to help American merchant marine and American ship building. It is now up to congress to pass laws which will encourage the building of ships in this country, and I feel congress will not fail to do its duty in this matter. If there is proper legislation our merchant marine will grow to enormous proportions and ship building in the United States will become the great industry it ought to be. What we want is to have ship yards established that will be fully equal to the great ship yards in Great Britain and elsewhere. True, we have not many first-class ship riveters here, but they can be easily secured and other mechanics can soon be shown how to do the work as well as those who do it at any of the great ship yards of the world. I have no doubt many men would come here from the region of the lakes and a number of skilled men from abroad."

SHIPS FOR SALT AND FRESH WATER.

PROBABLE RESULTS OF THE OPENING OF THE ST. LAWRENCE ROUTE—HOW THE MATTER IS VIEWED IN BUFFALO.

Buffalo, Nov. 21.—One thing at least has been accomplished by the deepening of the St. Lawrence route. It has set certain vessel owners crazy to make a trial of the double traffic, and it will not be long before something tangible will be evolved. Certain Buffalo vessel owners confess that they have information on the subject by the bushel, obtained from all possible sources, European as well as American. It appears to have been from the apparent showing of this information that the new Northwestern Transportation Co. began to build its fleet in Chicago, for of course no such venture would be started without a good deal of figuring of some sort.

I am convinced, though, that the movement will prove anything but an advantage to the lake fleet as such, though I suppose that business is business, and the injury of one person's interests or the ruin, even, of one trade in trying to build up another is always called good business. There is going to be a class of steamers, and there are quite a good lot of them now, of the 258-ft. length, that will from this time on play a sort of hide-and-seek game between the lakes and the ocean. When business is best on the lakes they will be there, and when the opposite is true, and in winter, they will be on the ocean, dividing the business, in both cases, with the stationary fleet. It will take a very slight advantage, in these days of small margins, to make this roving fleet a large one.

There are not a few vessels already preparing to enter the new trade on its merits. The freight will be loaded on the upper lakes and landed in Liverpool and there will be a return cargo. It is already announced that a class of high-paying freight has been discovered that will exclude grain and flour so long as it lasts. Of course if there should prove to be a large amount of this freight it would add very much to the chances of success, though it would have to be taken at a rate that would underbid the package-freight liners of the lakes, which seldom make any money as it is.

There are to be a good many discoveries in regard to the new St. Lawrence route. Some of them are made now and they are not so very reassuring. There are times when the Canadian authorities will not allow a vessel to enter the Welland canal drawing more than 13 ft. 6 in., and though the steamer Huron has carried 80,000 bushels of corn into lake Ontario, there will be whole seasons when the amount will be cut down to 60,000 bushels. It is figured that a steamer can make a round trip to Liverpool from Chicago in 40 days, as against six to Buffalo, so it will be seen that the freight must have to be several times the mere lake rate. Then the season is very short, so that five trips will be unusually good. When the Crosthwaite steamer Waccamaw was preparing to leave Toledo for the ocean in mid-summer, or the next thing to it, the insurance companies demanded 4 per cent. to see her safe to New York, a matter of $6,000 on a $150,000 boat. Lower rates have since been obtained, but on hull and cargo they are always going to be pretty stiff.

It is noted that the appearance of the 500-ft. steamers on the lakes has apparently shut off the arguments in favor of a new ship canal to the sea. If one should be built of course these big fellows would demand a share in it, and the first cost of such a structure would be something prodigious. In spite of the apathy of the politicians on the subject, it is confidently believed that the 20,000-bushel barge-canal plan for the Erie canal route is to be tried and the friends of it rather welcome the St. Lawrence ventures, if only as an incentive to activity against Canada, which will never be allowed to control the traffic from the lakes to Europe.

I find that the Crosthwaite steamer Georgetown was about to be rejected on account of the lateness of the season, but was accepted on the builders agreeing to let her go now and doing considerable work on her in New York. If the St. Lawrence season is to be clipped a month at each end of the Buffalo season we do not fear it much, especially as the underwriters state that the Georgetown's single trip insurance about equaled a whole season's insurance on the lakes.

JOHN CHAMBERLIN.

TO RECOGNIZE GALLANT NAVAL OFFICERS.

Advices from Washington are to the effect that Secretary Long will renew his recommendation to congress for fitting recognition of the gallantry of officers who distinguished themselves during the Spanish-American war, with probably a similar recommendation as to those who have performed conspicuous service in China. The recommendation will follow the general lines of that made to former congresses, for legislation looking to a rearrangement of the promotion system, so that promotions for gallantry will not affect officers further down in the line by increasing the number of officers ahead of them, or else by a system of rewards through medals.

The Allan line, touching at Boston, has bought one new steamship and ordered another. The one bought is at present on the stocks of Sir Royalton, Dixon & Co., on the Tees. She is 450 ft. long, 56 ft. beam and registers 9,000 tons. She will be ready for service in January. In addition to the Pretorian, a second new steamer is under construction for the same company at Belfast. This vessel will be thirty feet shorter than the Bavarian or Tunisian, but of almost equal tonnage and carrying capacity. She will differ from the Bavarian and Tunisian in that she will have four masts, instead of two, and her passenger accommodations will not be quite so extensive as the other two new steamers. The plans for an additional new steamer have been prepared, and this new vessel will be finer and have more extensive passenger accommodations than any other steamer completed for the line. All the vessels will have twin screws.

The dismantling of a steel plant at Danville, Pa., for its transfer to the Clergue interests at Sault Ste. Marie, Ont., has begun. The work is being undertaken by W. H. Munroe, head mechanic for the Lake Superior company. The plant will include blast furnaces, smelting works and a steel rail mill. Two of the buildings will be 600 ft. in length and one of them will be 1,000 ft., and in addition there will be a number of smaller buildings.

AMONG SHIP BUILDERS OF THE GREAT LAKES.

When a contract was placed with the American Ship Building Co. for the construction of the steamers Paraguay and Asuncion, and their two steel tow barges, which are to engage in Atlantic coast trade, it was said that as many as twenty such vessels were to be built by the company, of which Mr. A. B. Wolvin of Duluth is manager. This statement is again heard, as a rumor, and it is claimed that the keels for the vessels will go down at different yards of the American company just as fast as berths become vacant towards spring. Mr. Wolvin and his associates are not, however, making public their plans on this score. Several officials of the consolidated ship yards are interested in the company that is sending the first four Wolvin vessels to the coast. It is also rumored that John Gordon of Buffalo, who has been at work for a long time past on the formation of a company to build two large steamers for passenger service between Chicago and Buffalo, stopping at several intermediate points, has found capital for his enterprise and will soon be prepared to contract for the construction of the vessels. Mr. Gordon's plan is to build two vessels costing $1,000,000, and to have them designed so that cabins for passenger accommodations may be removed and the vessels put to carrying grain and other freight in spring and fall.

Mr. John J. Hill of the firm of Morley & Hill, who have operated a ship yard at Marine City, Mich., for the past thirty years, has moved to Tacoma, Wash., for the purpose of establishing a ship yard at that point. During Mr. Hill's business career at Marine City as master builder and designer of wooden vessels, he established a reputation second to none on the great lakes, and the shipping interests of the Pacific coast are to be congratulated that he has decided to take up ship building among them. Since Mr. Hill has been connected with Morley & Hill that firm has designed and built some of the largest and best wooden vessels of lake service, among them the steamers Italia, W. B. Morley, New Orleans, St. Lawrence, J. J. Hill, Santa-Maria, Caledonia, Louisiana, Minneapolis and Northerner; also the steamer Mary, one of the fastest passenger vessels ever floated in the lake region. Other vessels have been designed and built at the Marine City yard—the foregoing is only a partial list—and all have reflected great credit upon Mr. Hill.

It is reported from Toledo that in addition to a contract for a steel passenger steamer to operate between Holland and Chicago, secured a short time ago, the Craig Ship Building Co. has also booked an order for a passenger steamer to take the place of the steamer American Eagle on the Sandusky, Lakeside and Catawba island route. The vessel is to be finished next spring and is to cost $50,000.

A Toronto dispatch announces that the Richelieu & Ontario Navigation Co. has awarded a contract to the Bertram Engine Works Co. of Toronto for a passenger steamer for the Toronto-Quebec route. The vessel is to be 340 ft. long, or about 60 ft. longer than the Toronto, built recently for the R. & O. Co.'s upper route.

One of the New York financial papers claims to have information to the effect that directors of the American Ship Building Co. have decided to list the stock of the company on the New York exchange.

THE HILL PACIFIC STEAMERS.

The Review published last week from such information as was obtainable a short description of the large cargo and passenger steamships building for the Great Northern Steamship Co., James J. Hill, president, by the Eastern Ship Building Co. of New London, Conn. The New London company, now that the keels are being laid, has issued an authoritative statement regarding the ships. They are very much larger than any vessels at present afloat. Dimensions are 630 ft. long, 73 ft. beam and 56 ft. depth. They have a displacement of 33,000 tons, a gross tonnage of 20,000, and cargo holds of sufficient capacity to carry 28,000 tons of coal. The propelling machinery consists of twin-screw triple-expansion engines and Niclausse water tube boilers. Each vessel will carry about 1,000 passengers, a crew of 250 men, a large number of cattle, and will be fitted for the carrying of all classes of ocean freight. The speed is stated at 14 knots and the price $2,250,000 to $2,500,000 each. These vessels, hull and machinery, have been designed throughout by the Eastern Ship Building Co., Charles R. Hanscom, president and general manager, and William A. Fairburn, naval architect and engineer. They will receive the highest rating in the British Lloyd's and will be completed in the summer of 1902.

LECTURES ON STEEL FORGINGS.

In the evenings of Nov. 20 and 27, Mr. H. F. J. Porter of the Bethlehem Steel Co., will address the classes of the Brooklyn Institute of Arts and Sciences in the public lecture course, his subjects being "Development of the Forging Industry" and "Modern Methods of Making Steel Forgings," respectively. On Nov. 24 the lecture last mentioned will be repeated before the German Technical Society of Philadelphia, and on Saturday evening, Dec. 8, Mr. Porter will exhibit before the Winter Conversazione of the Franklin Institute in that city turnings made by tool-steel treated by the Taylor-White process, which the Bethlehem company is exploiting.

A book of sailing directions for Lake Superior and the St. Mary's river, just issued by the United States hydrographic office, is corrected to date, and should be in the hands of mates and wheelmen, who are desirous of advancement, as well as the captains. Its value is not in the sailing directions alone, as it contains rules of the road, several pages of information relating to the compass and barometer, descriptions of harbors, etc. Similar publications for the other lakes will be issued as rapidly as possible. Only 30 cents is charged for this first book. The object is to put it within reach of all men aboard lake vessels. It may be had from the Marine Review.

The steamer Ossifrage of the Arnold Transit Co. has been purchased by the Algoma Central Steamship Co. (Francis H. Clergue of Sault Ste. Marie, Ont.), and will be placed on the passenger run between the Sault and Michipicoten next season. The Ossifrage will be turned over to the Algoma company at the close of navigation and will receive a thorough overhauling during the winter. It is understood that Mr. Clergue will purchase another vessel of this kind for his operations in and around the Sault.

RELEASING DEVICES FOR LIFE BOATS.

Editor Marine Review:—The Marine Journal of the 10th inst. has in its editorial columns a discussion of the law on the subject of releasing devices for life boats. The discussion was raised by the issuance from this city of a circular purporting to contain the law on the subject. The circular quotes section 4,488 and 4,489 of the revised statutes, which in plain language require all vessels carrying passengers to be equipped with releasing devices. The law on the subject was not entirely stated in the circular. Section 4,491 of the revised statutes gives the board of supervising inspectors of steam vessels the sole and absolute authority to decide as to whether any device offered fulfills the requirements of the law as set down in sections 4,488 and 4,489. The situation then is this: The object of all the laws on the subject is the protection of the lives and property of those citizens whose business or pleasure calls for the use or occupancy by them of steam or sailing vessels. Sections 4,488 and 4,489 alone would make it obligatory on all vessel owners, captains and inspectors to see that every vessel is equipped with a releasing device, having certain qualifications for service. Section 4,491 in its operation relieves all owners and captains of their responsibility by giving the board of steamboat inspectors absolute authority to first select a correct releasing device, and also places upon the shoulders of the inspectors the entire responsibility for loss of life should a device exist which will fulfill the requirements of the law and which has not been adopted by them. The inspectors should eagerly scan the field of invention for the required device. It should be their business to know of all releasing devices in existence and test thoroughly anything which might solve this most vital question. There is a device in existence which has fulfilled for a number of years in actual every-day practice the requirements of the law, and as this device has not been adopted by the board of supervising inspectors of steam vessels, they have exhibited ignorance of the subject, negligence of duty, or, worse than all, have allowed their personal feelings to interfere with their duty and prevent the adoption of a proper safeguard, imperatively demanded by the law, for the protection of the seagoing public. The device spoken of has been tested, adopted and used for a number of years by the United States navy department, by the United States revenue marine, by the United States light-house board, by the United States coast survey, by the United States army transport service and by individual owners to the number of over two thousand sets. Does it appear possible that the board of supervising inspectors has gained within its experience a knowledge ponderously greater than the combined intelligence and experience of the many other bureaus of the government just named? As a board organized especially for inspection purposes they have decided that there is no device available under the law. If their opinion is correct, the judgment and experience of the officers engaged in the same lines of duty in other maritime departments of the government, as well as the many practical seamen who have used and endorsed the device, are at fault. But if the opinion of these other officers of the government and practical men in the merchant marine is correct and the device is useful and available, then the responsibility for all loss of life rests upon the shoulders of the board of supervising inspectors of steam vessels.

In conclusion, is there anything in the language of the statute that would forbid the selection of any good device, the universal use of which would familiarize all sailors with its operation? Would not the enforced use of a good device so selected prevent the terrible blunders and loss of life now so often occurring in emergencies because of the use of a multiplicity of defective devices.

PROCTOR.

Washington, D. C., Nov. 20, 1900.

ARMOR PLATE CONTROVERSY SETTLED.

The armor plate controversy has finally been settled and the battleships Maine, Missouri and Ohio will now be finished at once. The completion of these battleships has been delayed more than a year on account of the dispute over the price of armor. Secretary Long has issued the following statement regarding the settlement:

"The navy department has come to an agreement with the Carnegie and Bethlehem companies for Krupp armor of the first class amounting to 24,950 tons for $420 a ton. The Krupp process involves the Harvey patent, the validity of which is now under consideration by the courts, and it is further agreed that the government will assume in addition any liability for the Krupp process not exceeding $24.32 a ton for Krupp royalty, and not exceeding the United States license fee of $11.20 for Harvey royalty. The maximum price to the government is therefore $455.52 a ton, subject to diminution in case of any reduction in the foregoing royalties. The bid of these companies for this class of armor was $490, and the price originally asked $545. The Midvale Co. some time ago withdrew their bid, but they would have been unable, in any event, to furnish armor in due season for the Maine class of battleships. Had they not withdrawn their bid, it is probable that some arrangement might have been made for the distribution among the three companies for the manufacture of the armor other than that of the Maine class. Their bid, however, was of no value in enabling the department to secure the above large reduction."

This establishes a far lower price than that which any other nation has ever been able to obtain armor plate for.

What is known as the Buffalo dock, operated by Pickands, Mather & Co. at Buffalo, bearing 60,000 tons of ore, caved in on Monday morning and dumped the ore into the Blackwell canal, killing two boys and injuring one man in its fall. The night shift on the dock were working on the steamer Marina at the time, which was discharging her cargo at the dock. When the dock began to slide the steamer was forced across the slip and her lines parted under the strain. The steamer was uninjured. It is supposed that quicksand was the cause of the caving in of the dock. The derricks, tramways and mechanical equipment for unloading cargoes went into the canal with the dock. The loss is estimated at $150,000.

The order for the new yacht to defend the America's cup next August has been placed with the Herreshoffs. Work will be carried on with the utmost expedition as it is expected to launch her in April. It is understood that Cornelius Vanderbilt and August Belmont are interested in the syndicate which is financing the American yacht.

IMPROVED BUSINESS OUTLOOK.

It is certainly fortunate for the vessel interests of the great lakes that conditions generally in iron and steel lines have changed for the better in the closing days of navigation. With the completion during the next few days of negotiations now pending, it is expected that orders for steel rails alone for 1901 delivery will aggregate a million tons. Sales of pig iron during the present month will probably exceed all previous records. This improvement is, of course, of no value for the season of navigation now at an end, although it probably had some bearing upon the few final cargoes of iron ore that are being brought down, and for the movement of which $1 a ton from the head of Lake Superior has been paid within the past few days, as against a 60-cent rate that prevailed a couple of weeks ago. But if the present healthy condition of the iron market continues through the winter, it will have a decided effect upon lake freights. A week or two ago the vessel owner could see nothing more than 60 cents a ton for 1901 lake freight ore contracts, and that rate he could not accept without radical reductions from present operating expenses, especially as regards handling charges. It was evident that an effort to reduce these charges would mean serious labor troubles, but now an active iron market may warrant the payment of freights that will not require radical reductions in operating expenses. In any event, it would seem that the only policy for the vessel owners at present is to avoid hurrying contracts for another year's business.

AROUND THE GREAT LAKES.

A notice from Commander Symonds of Chicago, inspector of ninth light-house district, announces that Lansing shoal, White shoal and Gray's reef light vessels, near Straits of Mackinaw and the Eleven-foot shoal light vessel, Green bay, have been directed to leave their stations for the winter on or about Dec. 10.

Col. Jared A. Smith, United States engineer at Cleveland, who has received orders of transfer to San Francisco, will be tendered a farewell reception by the members of the Cleveland Chamber of Commerce on the evening of the 28th inst. Col. Smith has consented to address the members of the chamber on this occasion. He will illustrate by the stereopticon the improvements which have been made in recent years in Cleveland harbor, and the proposed breakwater extensions, for which the chamber has so earnestly labored.

During the Spanish war engineer officers of the war department were taken from regular river and harbor work in a number of cases. As a result of one of these transfers, Col. G. J. Lydecker of Detroit was called upon to look after harbor work along the eastern district of Michigan, in addition to his important duties connected with the big improvements in the St. Mary's river, Detroit river and other connecting channels of the lakes. It is now announced that Col. Lydecker has been relieved of the harbor work in the eastern district of Michigan and that the same has been turned over to Major Fitch, who will soon have offices established in Detroit.

Grain shipments from Chicago have certainly been the mainstay of the lake trade this season. Shipments from Chicago and South Chicago for the week ending on Saturday last were 3,839,000 bushels, including 1,430,000 bushels wheat, 1,727,000 bushels corn, 614,000 bushels oats, 18,000 bushels rye, 50,000 bushels barley. There was an increase over the previous week of 651,000 bushels in the aggregate. The movement to Canadian ports was largely increased, the gain being 567,000 bushels out of a total of 1,252,000 bushels, or 32 per cent., over 50 per cent. of which was corn. Shipments to Buffalo were 56 per cent., or 2,161,000 bushels, including 968,000 bushels of wheat. For the previous week the movement to Buffalo was 73 per cent., and to Canadian ports 21 per cent.

Capt. George P. McKay, chairman of the Lake Carriers' committee on aids to navigation, has received a letter from Maj. Thomas H. Handbury, engineer of the Eleventh light-house district, requesting an expression of opinion from the association as to the desirability of retaining the Isle aux Peches range in permanent form after satisfactory lights have been placed on both sides of the 20-ft. channel on St. Clair flats. In January last Major Handbury, in conjunction with Commander Duncan Kennedy, inspector of the district, made a report to the light-house board recommending the reconstruction of the range lights at a cost of $11,000, and other changes which the board has adopted in its report to congress. Gen. Wilson, who made an inspection of the district during the early summer, does not think the range lights necessary. In fact he thinks they are a menace to navigation. The board has therefore referred the subject back to Maj. Handbury.

One of the surest indications of the wave of prosperity that has been sweeping through the iron trade in the past three weeks is the general deprecation of anything like a boom. The stream of orders has been so steady from every quarter since the election, as to suggest the danger that last year's excitement might be repeated. Strong as the situation is from every point of view, it does not appear as yet that the mistakes of 1899 will be repeated. The time of year is against such repetition; producing capacity is ample for all probable needs, and foreign iron markets are receding, so that the outflow of export steel is likely to be checked. The past week has given added evidence of healthy activity in all districts and in all lines of production.—Iron Trade Review.

A wooden steamer that is expected to carry about 800 passengers in excursion service and make 20 miles an hour, was launched a few days ago from the ship yard of the Bellingham Bay Improvement Co. at New Whatcom, Cal. The vessel was named General Frisbie. She is owned by the Monticello Steamship Co. (Hatch Bros.) of California. Dimensions are: Length over all, 170 ft.; keel, 160 ft.; beam, 25 ft.; depth of hold, 13 ft. The engines, which are to be about 12,000 H. P., will be installed at San Francisco.

If you contemplate a trip either west or east you can secure advantages not found elsewhere if you will write, wire, 'phone or call at the city office of the Nickel Plate road, 189 Superior street, 'phone main 218, or ticket agents Euclid avenue station, 'phone Doan 817. Rates and tickets, first or second-class, to any point authorized east or west at any station on the Nickel Plate road. 245, Dec. 31

WITH THE COAST BUILDERS.

A NUMBER OF NEW CONTRACTS ARE NOTED AND EXTENSIONS TO SHIP BUILDING PLANTS ARE IN CONTEMPLATION.

Following is a summary of the condition of ship building at Bath, Me.: At Kelly & Spear's yard are three barges 240 ft. long, 43 ft. wide and 19 ft. deep. They are for the West Indian trade, and there is a fourth one to build. One of these vessels is being ceiled, while the other two are framing. In the same yard is a four-masted schooner for Charles E. Hirsch of New York. She is a single-decked vessel designed for the lumber trade, is 160 ft. long, 35 ft. wide and 13 ft. deep. She is being framed. At the New England yard the schooner Louise B. Clary, a five-master, for Capt. Wm. H. Potter, was launched on Tuesday. She is 250 ft. long, 40 ft. wide and 20 ft. deep. She will be of about 2,000 tons. The riggers are now at work upon her. The recently launched Clifford N. Carver, a four-master, is at the wharf having her masts stepped and rigging put on. Capt. Thompson of Watertown, N. J., is to command her. The planking if half done on a four-master for Capt. George Kelsey of Clinton, Conn. She is 182 ft. long, 40 ft. wide and 18 ft. deep. The New England Co. has a cargo of yellow pine on the way for the schooner William Collins. On the marine railway is the schooner Henry H. Chamberlain, built a few years ago by Frank S. Bowker of Phipsburg. At the Sewall yard one of the big ships for the Standard Oil Co. is being made ready for launching, which occurs the first week in December. She is 6 in. longer than the ship Arthur Sewall. The second ship has been commenced and the keel is ready for a third one as soon as the first goes overboard. At the Bath Iron Works the monitor No. 8 and the torpedo boat Biddle are scheduled to be launched this month. Work is well along on the tug and the cruiser Cleveland. The torpedo boats Barney and Bagley are fast nearing that stage when an official trial can take place. At the Houghton yard Capt. Hawley's schooner is nearly planked. At the Percy & Small yard the six-master Eleanor A. Percy is ready for sea, while a five-master is being framed. At Deering's yard the crew is putting the planking on a four-master.

Contracts for the construction of two first-class steel, steam, twin-screw ferryboats for the Central Railroad of New Jersey have just been awarded to the Harlan & Hollingsworth Co., Wilmington, Del. The boats are to be 207 ft. in length, 65 ft. beam, 17 ft. deep and will be fitted with triple expansion engines. Steam will be supplied by three Scotch boilers. Two cabins will be built on the main deck with two drive or wagon ways. The saloon will be on the upper deck and will be constructed of hard wood. The boats are to be built with all possible speed and the material for their construction is now being ordered.

William E. Woodall & Co., Baltimore, Md., have purchased a large tract of land with a water frontage of 250 ft. adjoining their present ship yard on the south side of the basin for $40,000. The company is preparing to improve its floating dock and plans are now under consideration which will give the dock a raising capacity for vessels of 500 tons greater weight than can now be raised.

Lewis Nixon has now under construction at his Elizabethport yard an auxiliary schooner yacht, 82 ft. long, designed by Cary, Smith & Barbey for Chester W. Chapin of New York. The same designers have closed a contract with the Poillons of South Brooklyn for a full rigged schooner yacht with auxiliary power.

Capt. E. H. Smead of Providence, R. I., is having built at Mystic, Conn., a five-masted schooner for the coastwise trade. The vessel is to be 230 ft. long, 45 ft. 8 in. beam and 24 ft. 3 in. deep. She will be fitted with a 30 H. P. engine. The five lower masts will be of Oregon pine, 110 ft. in length; topmasts 54 ft.

The large naval tug Osceola, which is now in dry dock at the Charlestown navy yard, Boston, will require more extensive repairs than was at first anticipated. Several of the bottom plates were found to be damaged.

The Electric Boat Co., New York, has arranged to establish a permanent testing plant at Suffolk, L. I. Work upon the basin has been started. A frame machine shop, 20 by 50 ft., is now being erected.

The navy department will in a few days call for bids for constructing two new piers and extending a sea wall at the Charlestown navy yard. The cost of the improvement will be about $150,000.

It is understood that ex-Mayor Herman Walker of Guttenberg, N. Y., is endeavoring to enlist capital in the establishment of a shipbuilding plant at North Bergen, N. Y.

The old single turreted monitor Nantucket, which was built during the civil war, was sold by the navy department last week to Thomas Butler & Co., Boston, for $13,000.

Weston & Co., Jacksonville, Fla., have placed an order for a 700-ton, four-masted schooner, with the New England Ship Building Co.

A charter has just been granted to Flint, Eddy & Co., Norfolk, Va., to conduct a general importing and exporting business and to operate steamships. The capital is $500,000 and the principal office in Norfolk. W. B. Flint of New York is president; Louis E. Odio, Buenos Ayres, Argentina, vice president; Diego Campbell, Buenos Ayres, treasurer; William R. Stevens, New York, secretary. The directors are Frederic B. Jennings, Trenor L. Park, Ulysses D. Eddy, Alfred DeBuys, George L. Duvall and Thomas A. Eddy, all of New York.

Chief Carpenter Josiah E. Keen has just been placed on the retired list of the navy on account of age, with the rank of ensign. This is the first case where a man who served throughout his entire naval career in the enlisted grades has been retired with the rank of a commissioned officer. The authority to so advance him was found in the personnel act of May, 1899. Keen will be entitled to wear the uniform of an ensign on occasions of official ceremony, such as receptions at the White House.

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TRADE NOTES.

The Penn Steel Casting & Machine Co., Chester, Pa., intends to enlarge its plant.

A New York correspondent says: "I find that many practical engineers are recommending De Puy's Paragon boilers. Riter Bros. & Co. at Buffalo are building two of 150 H. P. each for marine use. They are to withstand 150 lbs. steam pressure according to government test. A new beet sugar works has decided to install four of these boilers of 250 H. P. each, and arrangements are also being made for two of the same power for a city water works.

The Bethlehem Steel Co. recently received an order from the Anaconda Copper Mining Co. of Anaconda, Mont., for a hollow-forged fluid-compressed steel shaft 17 ft. 10 in. long and 15¾ in. to 20 in. diameter with a 7-in. axial hole, to replace a shaft which broke in the hoisting engine of the mine, necessitating a shut-down until the new one could be received. The new shaft was taken in hand under emergency conditions and finish-machined complete within fourteen days from receipt of order, which was two days in advance of contract agreement. It weighed about 12,000 lbs., and, on account of the urgent nature of the case, was shipped to Anaconda by express in a special car.

The Montauk Multiphase Cable Co., No. 100 Broadway, N. Y., has issued a tasty little catalogue devoted to a portable fire detector which they are manufacturing. It consists of a reel of Montauk fire-detecting wire, a 6-in. gong and the necessary dry battery, all mounted on a suitable wooden case, connected and ready for business. Its most decided advantage is its portability. The wire, being flexible, can easily be led around and over piles of inflammable material, and when so distributed serves as a fire protection unexcelled. Unreeling 100 ft. of fire detecting wire is similar to distributing many times that number of thermostats. In dock sheds and freight stations it is invaluable.

The American Bridge Co. has just closed a contract with the North German Lloyd Steamship Co., calling for the erection of two steel buildings on the banks of the River Weser at Bremen, Germany. The machine shop building will be 100 ft. in width and 300 ft. in length, two stories in height. The foundry building is 75 ft. in width and about 600 ft. in length. Both buildings are designed after the best American practice. The contract has been secured by the American Bridge Co. in competition with the best German bridge shops, and shows the extent to which this class of work can be carried. This is a great triumph for the American Bridge Co. The company also has a contract for furnishing over 700 tons of structural steel to go to the New York navy yard naval powder depot, near Dover, N. J., and to the naval magazine at Iona island.

INSPECTED THE CHARLESTOWN NAVY YARD.

Rear Admiral Hichborn, chief of the bureau of construction and repair, recently visited Boston and while there made an inspection of the Charlestown navy yard.

"I was very much pleased with my visit," said he. "There is probably no plant on the coast which it is necessary to have in so thoroughly efficient a state as the one in Boston, and for that reason the district is to be congratulated in having so able and energetic an officer as Admiral Sampson in command of the yard. He takes great interest in the development of the construction plant, and in his desire in this direction is ably seconded by Naval Constructor W. J. Baxter, whose experience especially fits him for filling the important position which he does at Boston. The work which is being accomplished in the improvement of the plant is very considerable, and the boat shops, joiner shops, block shops and saw mills fitted up are probably—or will be when entirely completed—the equal of those in any first-class navy yard. Naval Constructor Baxter's plan for a power plant and the shops of the ship building side have been very carefully worked out, and, from what I could see of the work in progress, when completed they will put the yard in condition to undertake any class of work which might be required of it, from repairs to the building of the largest class of vessels. Admiral Sampson expressed considerable disappointment with the progress being made on the new dry dock, and from my own observation I felt that his feelings in this matter were certainly fully justified. The work seems to be practically at a standstill; and I am of the opinion that, if it were now taken up and pressed with the utmost dispatch possible, it would be impracticable to place this dock in condition to receive vessels of war for at least five years. Something should be done to insure that the work on the Boston dry dock will be taken up and prosecuted vigorously to completion. I noted also, with considerable surprise, that nothing whatever has been done toward the installation of the marine railway and torpedo boat storage appliances, for which appropriation was made as long ago as May, 1898."

Admiral Endicott, chief of the bureau of yards and docks, to whom Admiral Hichborn's statement was referred, said that he had previously ordered an investigation and had found that the principal cause of the delay was the bursting of a poorly constructed cofferdam. Concerning the torpedo railway Admiral Endicott said the plans are now ready and that bids would be solicited for its construction next month.

The North German Lloyd steamship Ems has been bought by a shipping firm of Liverpool. The Ems is one of the old iron single-screw ships of the North German Lloyd fleet.

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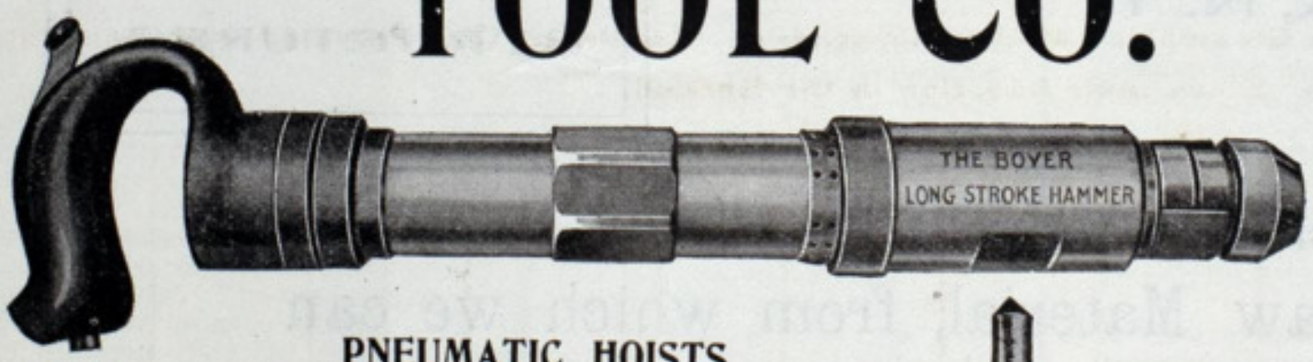

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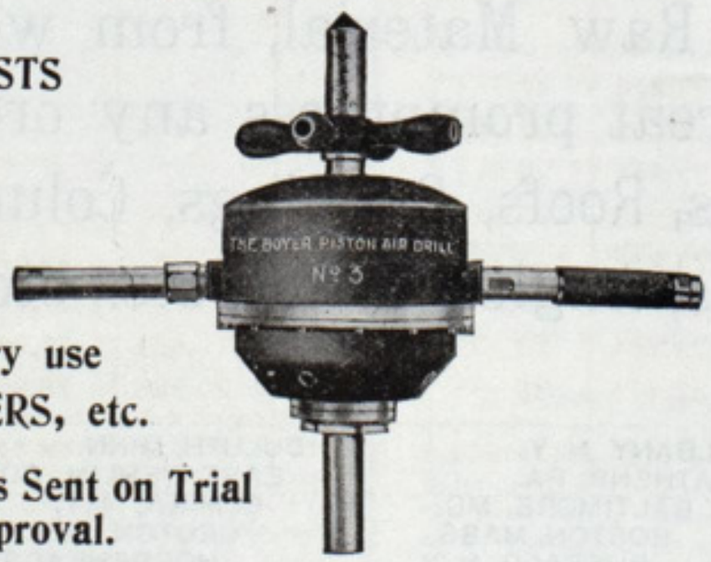

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THE JASON OF ALGOMA.

Principal Grant, of Queen's University, Kingston, has contributed to the October Canadian Magazine an article on "The Jason of Algoma," Jason in this case being F. H. Clergue, who is discovering and capturing the Golden Fleece of Algoma. The various industries which Mr. Clergue has and is establishing at Sault Ste. Marie are described in a very interesting way. The railway and steamship branches of Mr. Clergue's enterprises are referred to as follows:

"Additional industries are gathering round the canals, factories and mines, all contributing to the main object. When the Helen mine of iron ore was discovered near Michipicoten and a short railway brought it to a harbor ready for the market, transportation to the Midland blast furnace and other points became an immediate necessity. But the ship-brokers could not supply steamers or barges. All were pre-engaged. The right men were at once despatched to Britain, to purchase four steamers with the largest carrying capacity compatible with getting through our system of lakes. While I was at the Sault in August the last of the four arrived at the dock, near the new offices, with a cargo of 1,500 tons of Portland cement, bricks and other stuff, brought from England right up into the heart of the continent, without breaking bulk! Is there another such system of inland navigation elsewhere in the world? These steamers are to be carriers all the year round. On the approach of winter, they will run down to the ocean and engage in the Atlantic coast carrying trade. Barges too are under way, for the outfit must be complete.

"We might be sure that railways as well as steamers would be planned. Three main lines, not counting branches, are now being constructed, located or contemplated, by the same intelligence which saw the possibilities of the Lake Superior mill-pond, and has ever since been engaged in turning the possible into the actual. The first is the Algoma Central, to run back to Missanabie on the main line of the Central Pacific railway. The second will extend the Algoma Central to the salt water of James Bay, the pocket of Hudson's Bay which bends down to within 300 miles of Missanabie. The third will connect the Sudbury region with the great Manitoulin Island, crossing the north channel of the Georgian bay at Little Current. Each of these promises to impart new life to large and hitherto hermetically sealed districts of the province. The first ten miles of the Algoma Central are completed already. I had a run over them in their unballasted condition, on a truck, in company with three or four American gentlemen who had come up from New York and Philadelphia to see the holes in the ground where their money was being sown. May they reap a good harvest! To my astonishment the line ran through a fairly-well wooded and well-settled rolling country. I had in my own mind previously given up the whole of that northern shore region as a hopeless barren and the day before I had been informed by an intelligent person in the Sault that it was simply that and never would be anything more. Most ignorant are we of what we are most assured. Well, settlers had filtered in, men with hearts of oak and that they had prospered, the fences, fields and buildings all along the line bear testimony. And now the sun had risen on them. The railway was at their doors to carry their stock and garden stuff, their butter, eggs and chickens to as hungry a market as the heart of farmer could desire. The company believes that there are fertile little valleys and patches of good land all the way to Missanabie, and so they have agreed with the government of the province to place on their lands, or the lands of the crown adjacent to their line, 1,000 male settlers annually for the next ten years. In consideration of this and other covenants, they are to receive, in fee simple, 7,400 acres of land for every mile of the 200 they are constructing to Missanabie.

"The necessity for building the line to Missanabie is apparent. But where is the need, and what is the object of pushing it 300 miles farther north? I am informed that the areas of pulp-wood and of mineral-bearing rock are more promising on Hudson's bay than on the Lake Superior watershed; and besides, the sea is there, and that means fisheries, at a distance of 500 miles from the Sault, whence fish can be shipped to Chicago on one side and St. Paul and Minneapolis on the other. Salt water fish are now carried to these markets over 2,000 and 3,000 miles of rail. How can Atlantic fish compete with their Hudson's bay kith and kin, once the 500 mile iron bridge has been built? The Manitoulin line is perhaps the most promising of the three. This great and fertile island, the largest in the world, surrounded by fresh water, has hitherto had no market for its products and has been isolated for weeks from the rest of the world twice a year. Population has, therefore, been attracted to it, but slowly, in spite of its stock-raising capabilities. No wonder that promises of a railway are demanded and freely made to do duty every time an election comes round. A friend writes me: 'Were it not for Mr. Clergue's connection with it, the present renewal of the project would be universally regarded by our people as a mere election dodge. We now feel sure. The Sudbury end of the line will be built first, and I believe that it will then be pushed across the channel to Manitoulin. The line will open up a very rich region on the north shore, a district rich in copper, silver, nickel and iron, also in timber and pulp-wood. From the mouth of the Whitefish river to Little Current there are few natural difficulties to overcome in building the line or in crossing. There is only one navigable channel and it is narrow and runs right past the town. The rest of the channel at this point is filled with a series of low-lying islands, composed of flat rock, of limestone formation, with scarcely any soil. Ultimately, the line will be pushed across the island to a point on the south or Lake Huron shore, where I believe there are one or two good harbors. The advantages to us I need not dilate on. For one thing, we dread the two periods annually of complete isolation, when the ice is forming and when it is breaking up.' Anyone who has spent a winter in Prince Edward island will sympathize with that feeling. How the island would rejoice if its isolation were only for a month, and what would it not give for a bridge or a tunnel!"

The torpedo boat Stockton, built by the William R. Trigg Co., Richmond, Va., has had a preliminary trial trip. She made a greater speed than her contract requirement of 26 knots. The runs were made with a view to the standardization of her propellers.

BELLEVILLE GENERATORS

Grand Prix 1889
Originated 1849

Hors Concours 1900
Latest Improvements 1896

Number of Marine Leagues made each year by Steamships of the Messageries Maritimes Co., Provided with Belleville Generators—Since their Adoption in the Service.

Year.	Australian	Polynesien	Armand Behic	Ville de la Ciotat	Ernest Simons	Chili	Cordillere	Laos	Indus	Tonkin	Annam
1890	22,576	820									
1891	22,749	22,777	68								
1892	22,749	22,801	23,274	7,753							
1893	22,793	22,781	22,762	22,749							
1894	22,813	22,789	22,858	22,813	12,567						
1895	22,891	22,922	22,913	22,936	13,629	9,571					
1896	23,178	30,906	23,232	23,183	20,735	21,051	13,572				
1897	22,750	23,202	30,912	23,185	20,745	25,370	21,119	14,382			
1898	23,646	23,178	23,184	23,199	20,842	21,080	21,080	20,851	21,318	7,569	
1899	23,178	23,205	22,477	30,135	20,082	20,926	20,956	17,448	18,285	14,669	7,628
Total	229,323	215,381	191,680	175,953	108,600	97,998	76,727	52,681	39,603	22,238	7,628

ATELIERS ET CHANTIERS DE L'ERMITAGE, À ST. DENIS (SEINE), FRANCE.
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TELEGRAPHIC ADDRESS: BELLEVILLE, SAINT DENIS, SUR SEINE.

PHOTOGRAPHS OF LAKE VESSELS.

It is not an easy matter to secure good photographs of lake vessels, even in the connecting rivers. This is especially true when an effort is made to get large pictures. A photographer who spent a couple of weeks in September on the St. Clair river making pictures for the Review did not succeed in getting all that he expected, but some of the views are very fine. The negatives are 11x14 in. No photographs of this size are to be had from any other source. There is no background in any of them—just clear sky and open water. Following is the list:

STEAMERS.

Angeline	Iosco	Pontiac
Birckhead, P. H.	Iron King	Pridgeon, John, Jr.
Boston	Kaliyuga	Princeton
Boyce, Mary H.	Leafield	Queen City
Buffalo (two views)	Linn, Wm. R.	Ravenscraig
City of Alpena (Side-wheeler)	McWilliams, John J.	Rees, W. D.
	Maruba	Reis, Wm. E.
Conestoga & Monarch (on one print)	Mariposa	Rhodes, W. C.
	Mataafa	Sacramento
Davidson, Thos.	Mills, Robt.	Saxon
Delaware	Nicholas, I. W.	Susquehanna
Eddy, John F.	Nicol, John M.	Sparta
Hanna, M. A.	Northern Light	Stevens, W. H.
Harper, John	Northern King	Syracuse
Hopkins, Mark	Penobscot	Tuscarora
Huron	Pittsburg (Pass. stmr.)	Wilbur, E. P.

TOW BARGES.

Abyssinia	Chattanooga	Olive Jeanette

A single print will be delivered to any address, express prepaid, at $1.50, or $5.00 for four. These photographs are too large to trust to the mails. If called for at the office of the Marine Review, Perry-Payne building, Cleveland, copies may be had at $1.25 each.

Plans of President J. J. Hill, begun more than a year ago, for his retirement from the presidency of the Great Northern Railway are nearly completed, and it was said at the general offices during the present week that the retirement will occur about Jan. 1, when Mr. Hill will become chairman of the board of directors, being succeeded by his eldest son, who is now general manager of the Great Northern, and who was recently elected president of the Montana Central. The annual meeting of directors of the Great Northern has been deferred now over a month to allow Mr. Hill to perfect the plans which are to relieve him of details.

It is announced in London that George L. Watson has received a free hand in designing Sir Thomas Lipton's cup challenger Shamrock II. It is also announced that Lipton will bring both the old and the new Shamrock to the United States. Watson has also received a commission to design a yacht for the emperor of Germany. Lipton's yacht will be built at Henderson's, Glasgow, and the emperor's at Denny's, Dumbarton, Scotland.

VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland, date of November 21, 1900.

NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire	51¾	52⅛	49¾	50⅜
American Steel & Wire, Pfd	89¾	90⅛	89½	89⅞
Federal Steel	52½	52¾	51¼	51¾
Federal Steel, Pfd	76¾	77¾	76¾	77½
National Steel	39	39⅛	38⅜	38⅝
National Steel, Pfd	91⅞	.....	.....	91⅞
American Tin Plate	44	44⅞	43⅝	43⅝
American Tin Plate, Pfd	88	89⅞	88	89⅞
American Steel Hoop	31⅞	32¾	31⅛	31⅛
American Steel Hoop, Pfd	78¾	78¾	79⅝	78⅝
Republic Iron & Steel	17½	17¾	16⅞	17
Republic Iron & Steel, Pfd	65	65¼	64¾	64¾

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Tug and scows, capacity of the latter to be 1,000 to 1,500 tons. Steam-barge owners correspond. Stone to be transported from our pier at Stone Haven, 7 miles north of Port Washington, to Lake Michigan ports. Lake Shore Stone Co., Belgium, Ozankee Co., Wis. tf

FERRY STEAMER WANTED.

Must be suitable for winter work. Send full information to "Ubique," care Marine Review Pub. Co., Perry Payne Bldg., Cleveland, O. Dec. 13.

WANTED.

A small steamer from 48 ft. to 60 ft. long. Draught not to exceed 5 ft. Simple power; good condition; speed 10 to 12 miles an hour. Boat is to be used as a ferry. Address Erie Yacht Club, P. O. Box 148, Erie, Pa. Dec. 6

MARINE FIRE BOX BOILER FOR SALE.

10 ft. long, 7 ft. 11 in. in height, 7 ft. 10 in. in width. Steam dome 42 in. diameter by 54 in. Two furnaces, 20 sq. ft. of grate surface each 124 tubes, 3 in. x 7 ft. 1 in. Boiler, built in 1897 by Pusey & Jones Co., Wilmington, Del., is as good as new with entire new furnaces and new tubes, and has breeching, grate bars, ash pans and stands. Will warrant the boiler to pass United States inspection for marine service at 100 lbs. working pressure. Price, f. o. b. steamer or cars, $1,600. The Johnson Iron Works, Limited, P. O. Drawer No. 241, New Orleans, La. Dec. 6

PASSENGER STEAMER FOR SALE.

Length over all, 177 ft.; beam on water line, 29 ft.; beam on deck (concaved) 40 ft. Rebuilt in 1893. Carries 500 tons freight. Allowed 500 passengers; will sleep 120 and can be made to sleep 200. Good cabin outfit. Steeple compound engines, double fire-box boiler. Speed, 11½ miles. Reason for selling is that vessel is not speedy enough for present service. Address Passenger Steamer,

tf THE MARINE REVIEW PUB. CO., Cleveland.

PASSENGER AND FREIGHT STEAMER WANTED.

Must have suitable night accommodations for at least 75 passengers, and freight capacity of not less than 300 tons, on draught not exceeding 13 feet. Address No. 400, the Marine Review Pub. Co., Perry-Payne Bldg., Cleveland, O. Dec. 6

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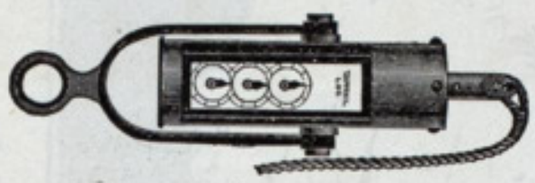

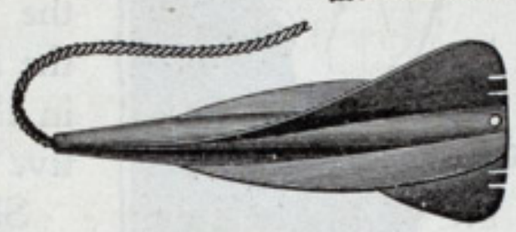

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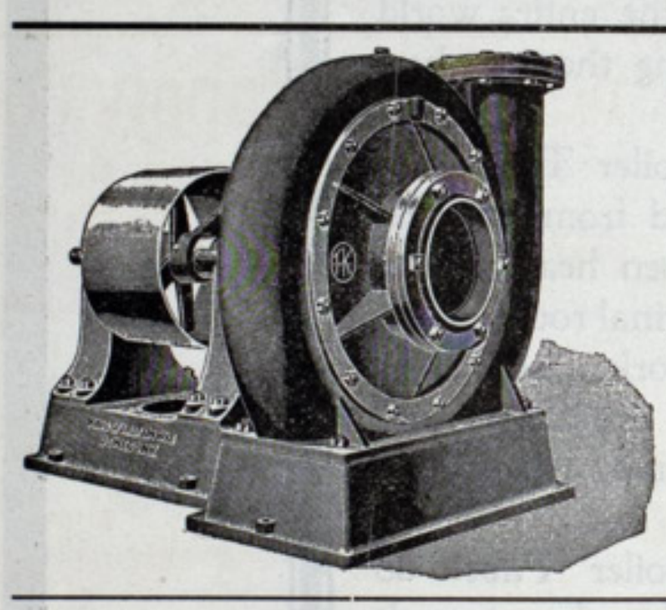

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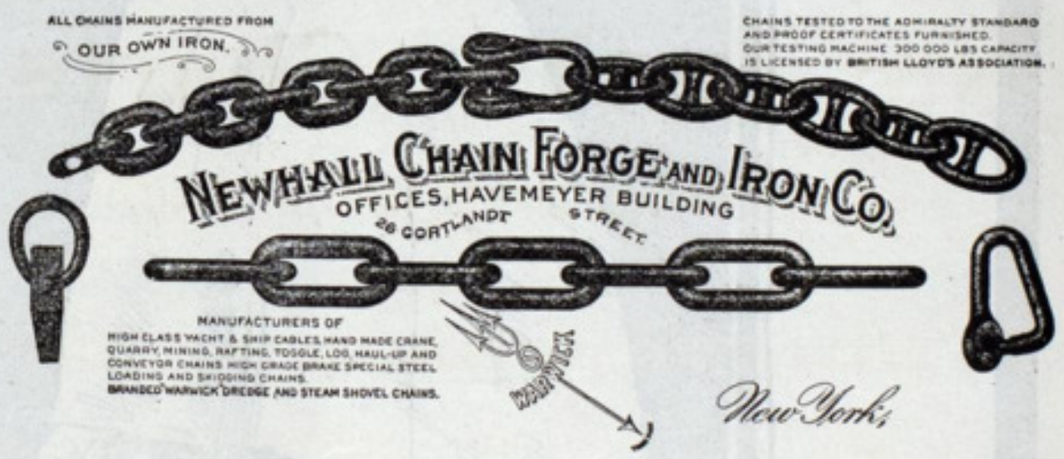

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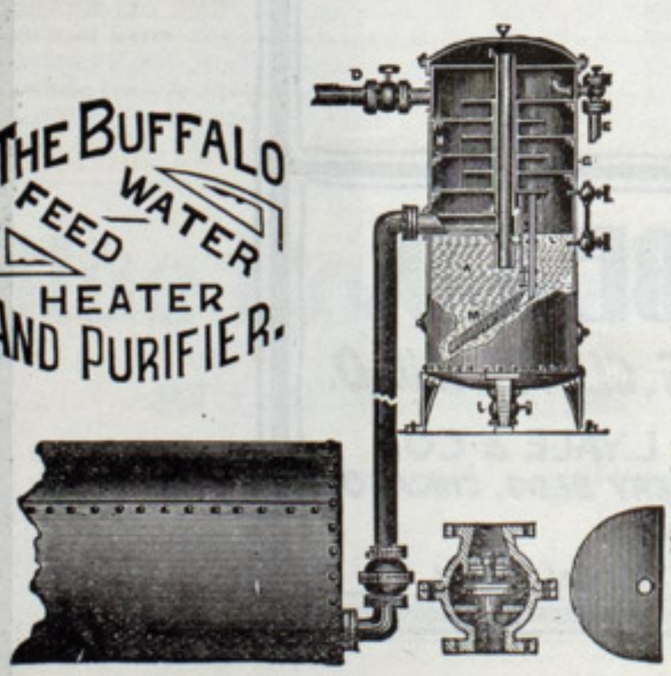

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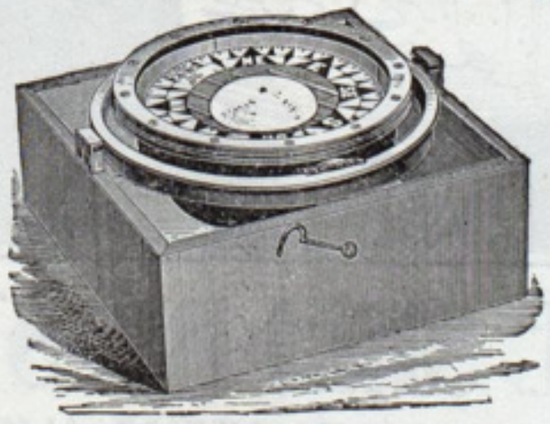

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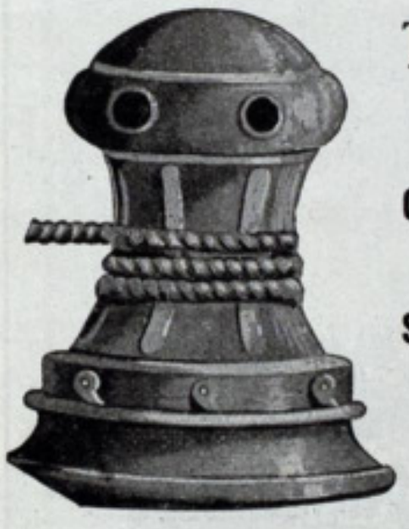

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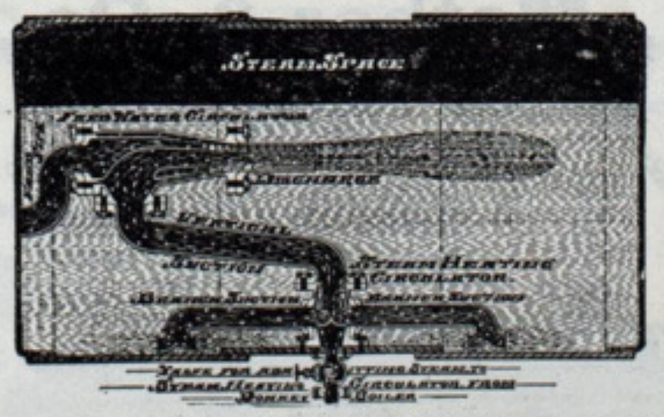

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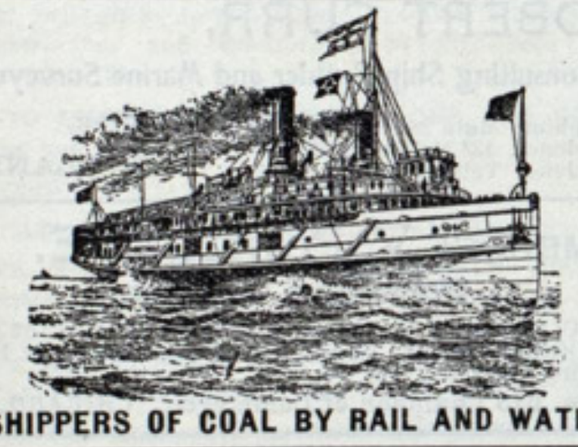

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McMyler Mnfg. Co.....Cleveland.

CABIN AND CABINET FINISHING WOODS.

Martin-Barriss Co.....Cleveland.

CAPSTANS.

American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

CHAINS.

Lebanon Chain Works.....Lebanon, Pa.
Monongahela Iron & Steel Co.....Pittsburg.
Newhall Chain Forge & Iron Co.....New York.
Standard Chain Co.....Pittsburg.

CHAIN HOISTS.

Boston & Lockport Block Co.....Boston, Mass.

CHUCKING MACHINES.

Niles Tool Works Co.....Hamilton, O.

CHUCKS FOR LATHES, DRILLS AND PLANERS.

Skinner Chuck Co.....New Britain, Conn.

CIRCULATOR, EQUILIBRIUM, with Steam Heating Attachment.

Bloomsburg & Co., H.....Newport News, Va.

CLOCKS (Marine), CHRONOMETERS, BELLS.

Ashton Valve Co.....Boston.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.

Castner, Curran & Bullitt.....Philadelphia.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.

COAL AND ORE HANDLING MACHINERY.

Brown Hoisting & Conveying Machine Co.....Cleveland.
Lidgerwood Mnfg. Co.....New York.
McMyler Mnfg. Co.....Cleveland.

COMPASSES.

Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

COMPASS ADJUSTER.

Simpson, Geo. A.....Sault Ste. Marie, Mich.

CORK JACKETS AND RINGS.

Armstrong Cork Co.....Pittsburgh, Pa.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

CORRESPONDENCE SCHOOLS—ENGINEERING AND NAVIGATION.

American School of Correspondence.....Boston.
Buffalo Nautical School.....Buffalo.
Chicago Nautical School.....Chicago.

CRANES, CONVEYORS, HOISTS.

Brown Hoisting & Conveying Machine Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York.
McMyler Mnfg. Co.....Cleveland.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

CRANK PINS.

Bethlehem Steel Co.....South Bethlehem, Pa.
Cleveland City Forge & Iron Co.....Cleveland.

DRILL PRESSES—DRILLS OF ALL KINDS.

Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

DRYING APPARATUS.

Sturtevant, B. F. Co.....Boston.

DRILLS, PNEUMATIC.

Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.

DRY DOCKS.

American Ship Building Co.....Cleveland.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Harlan & Hollingsworth Co.....Wilmington, Del.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Townsend & Downey Ship Bldg. Co.....New York.
Union Dry Dock Co.....Buffalo.
Union Iron Works.....San Francisco.

ELEVATORS.

Morse, Williams & Co.....Philadelphia.

ELECTRIC AUTOMATIC WHISTLE OPERATORS.

Signal & Control Co.....New York.

ELECTRIC LIGHT AND POWER PLANTS.

Buffalo Forge Co.....Buffalo.
Electro-Dynamic Co.....Philadelphia.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Sturtevant, B. F. Co.....Boston.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC HOISTS AND CRANES.

Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC STEERING GEAR, SPEED AND RUDDER INDICATORS, ETC.

Electro-Dynamic Co.....Philadelphia.

ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Engine Co.....Weymouth, Mass.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
Electro-Dynamic Co.....Philadelphia.

ENGINEERS, MARINE AND MECHANICAL.

Electro-Dynamic Co.....Philadelphia.
Hunt, Robt. W. & Co.....Chicago.
Miller, Walter.....Cleveland.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.
Powell, Ambrose V.....Chicago.
See, Horace.....New York.
Wood, W. J.....Chicago.

FANS FOR VENTILATION, EXHAUST, ETC.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.
Warren Webster & Co.....Camden, N. J.

FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.

FORGES.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FORGINGS, IRON AND STEEL.

Bethlehem Steel Co.....South Bethlehem, Pa.
Bourne-Fuller Co.....Cleveland.
Cleveland City Forge & Iron Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

FLUSHOMETERS.
Kenney, The Co.....New York.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

FUELING COMPANIES AND COAL DEALERS.
Castner, Curran & Bullitt (Pocahontas)....Philadelphia.
Graham, James & Co.....Detroit.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Smith, Stanley B. & Co.....Detroit.
Youghiogheny & Lehigh Coal Co.....Chicago.

GAS BUOYS.
Safety Car Heating & Lighting Co.....New York.

GAS AND GASOLINE ENGINES.
McMyler Mnfg. Co.....Cleveland.
Olds Motor Works.....Detroit.

GAGES, STEAM AND VACUUM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

HAMMERS, PNEUMATIC.
Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.

HAMMERS, POWER DROP.
Chase Machine Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

HAWSERS, WIRE.
American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting & Conveying Machine Co.....Cleveland.
Chase Machine Co.....Cleveland.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
McMyler Mnfg. Co.....Cleveland.
Marine Iron Co.....Bay City.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

INJECTORS.
Jenkins Bros.....New York.
Penberthy Injector Co.....Detroit.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys.....Milwaukee.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Pauly, H. J.....Milwaukee.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.

LAUNCHES—NAPHTHA, ELECTRIC.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.

MACHINE TOOLS.
Niles Tool Works Co.....Hamilton, O.

MACHINE TOOLS (WOOD WORKING).
Fay & Egan Co., J. A.....Cincinnati, O.
Atlantic Works, Inc.....Philadelphia.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Bloomsburg & Co., H.....Newport News, Va.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Magnolia Metal Co.....New York.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.

MILLING MACHINES OF ALL KINDS.
Niles Tools Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Curr, Robert.....Cleveland.
See, Horace.....New York.
Wood, W. J.....Chicago.

NICKEL STEEL FORGINGS.
Bethlehem Steel Co.....South Bethlehem, Pa.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Smith, Edward & Co.....New York.
Upson-Walton Co.....Cleveland.

PAINTING MACHINES, PNEUMATIC.
Chicago Pneumatic Tool Co.....Chicago.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.
Atlantic Works, Inc.....Philadelphia.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.

PLANERS OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.
Atlantic Works, Inc.....Philadelphia.

PLUMBING, MARINE.
Ellis Marine Plumbing Co.....New York.
Mott Iron Works, J. L.....New York.
Sands, Alfred B. & Son.....New York.
Kenney, The Co.....New York.

PNEUMATIC TOOLS.
Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.

PROJECTORS, ELECTRIC.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Davidson, M. T.....Brooklyn, N. Y.
Kingsford Foundry & Machine Works....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SCHOOLS, CORRESPONDENCE—ENGINEERING AND NAVIGATION.
American School of Correspondence.....Boston.
Buffalo Nautical School.....Buffalo.
Chicago Nautical School.....Chicago.

SCREW MACHINES.
Niles Tool Works Co.....Hamilton, O.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Townsend & Downey Ship Bldg. Co.....New York.
Trigg, Wm. R. Co.....Richmond, Va.
Union Dry Dock Co.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Marine Supply Co.....Fairport Harbor, O.
Moran Bros. Co.....Seattle, Wash.
Upson-Walton Co.....Cleveland.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEEL OR IRON STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL SHAFTS, SOLID OR HOLLOW.
Bethlehem Steel Co.....South Bethlehem, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.
American Bridge Co.....New York.

SURVEYORS, MARINE.
Curr, Robert.....Cleveland.
Gibbs & Joys.....Milwaukee.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TIMBER—LARGE PIECES.
Moran Bros. Co.....Seattle, Wash.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Chicago Pneumatic Tool Co.....Chicago.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Fay & Egan Co., J. A.....Cincinnati, O.
Atlantic Works, Inc.....Philadelphia.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.
Playfair's Barge & Tug Line.....Midland, Ont.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Swain Wrecking Co.....Detroit.

TUBING FOR BOILERS.
Shelby Steel Tube Co.....Cleveland.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Jenkins Bros.....New York.

VARNISH MAKERS, COLOR GRINDERS, ETC.
Smith, Edward & Co.....New York.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys.....Milwaukee.
Hall & Root.....Buffalo.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Mitchell & Co.....Cleveland.
Moffat & O'Brien.....San Francisco.
Pauly, H. J.....Milwaukee.
Richardson, W. C.....Cleveland.

VENTILATING APPARATUS FOR SHIPS.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.
Atlantic Works, Inc.....Philadelphia.

WORM GEARING.
Morse, Williams & Co.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Playfair's Barge & Tug Line.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

Almy Water Tube Boiler Co. 11
*American Bridge Co. 25
American Line 7
American School of Correspondence 6
American Ship Building Co. 1
American Ship Windlass Co. 2
American Steam Gauge Co. 1
American Steel & Wire Co. 1
Armstrong Cork Co. 40
Ashton Valve Co. 12
Atlantic Works 5
Atlantic works, Inc.

Babcock & Wilcox Co. 11
Baldt Anchor Co. 9
Baker, Howard H. & Co. 9
Bath Iron Works, Ltd. 1
Bertram's Oil Polish Co. 1
Bessemer Steamship Co. 32
Bethlehem Steel Co. 6
Big Four Railway 39
Blake, Geo. F., Mnfg. Co. 9
*Bliss, John & Co. 30
*Bloomsburg & Co., H. 31
Boland, J. J. 34
*Boston & Lockport Block Co. 40
*Boyer Water Tube Boiler Co. 31
Bourne-Fuller Co. 12
Brown & Co. 34
Brown Hoisting & Conveying Mach. Co. 2
Buffalo Dry Dock Co. 11
Buffalo Forge Co. 12
Buffalo Nautical School. 6

Castner, Curran & Bullitt. 33
Champion Rivet Co. 8
Chase Machine Co. 6
Chicago Nautical School. 6
Chicago Pneumatic Tool Co. 26
Chicago Ship Building Co. 2
Cleveland & Buffalo Transit Co. 39
Cleveland City Forge & Iron Co. 6
*Cleveland Punch & Shear Works Co. 30
C. C. C. & St. L. R. R. 39
Continental Iron Works. 2
Cory, Chas. & Son. 10
*Craig Ship Building Co. 30
Cramp, Wm., & Sons, S. & E. B. Co. 1
Crandall & Son, H. I. 7
Crosby Steam Gage & Valve Co. 12
Crowl, Samuel H. 34
Curr, Robert 34

Davidson, M. T. 9
Dearborn Drug & Chemical Works. 30
Delauney, Belleville & Co. 27
Delaware River Iron S. B. & E. Works 5
Detroit Shipbuilding Co. 1
Detroit Screw Works. 11
Dixon Crucible Co., Joseph. 9
Donnelly Salvage & Wrecking Co. 32
Drake & Maytham. 34
Drein, Thos. & Son. 4
Duluth, South Shore & Atlantic Ry. 39

Egan Co., The. 7
Electric Boat Co. 8
Electro-Dynamic Co. 1
Ellis Marine Plumbing Co. 7
Elphicke, C. W. & Co. 34
Elwell-Parker Electric Co. 2
Erie & Western Trans. Co. 32

Falls Hollow Staybolt Co. 4
Farrar & Trefts. 5
Fay & Egan Co., J. A. 7
Fletcher, W. & A. Co. 4
Fore River Engine Co. 5
Fogg, M. W. 31

Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated. 31
General Electric Co. 12
Gibbs & Joys. 34
Gilchrist, Albert J. 34
Goulder, Holding & Masten. 34
Graham, James & Co. 33
Great Lakes Register. 7

Hall & Root. 34
Hanna, M. A. & Co. 32
Hardy, John B. 4
Harlan & Hollingsworth Co., The. 5
Hawgood & Moore. 34
Helios-Upton Co. 6
Helm, D. T. & Co. 34
Herriman, F. D. 7
Hodge, S. F. & Co. 8
Holmes, Samuel. 34
Hoyt, Dustin & Kelley. 34
Hunt, Robert W. & Co. 34
Hutchinson & Co. 34
Hyde Windlass Co. 40

International Anchor Co. 9
International Navigation Co. 7

Jenkins Brothers. 10-12
Jenks Ship Building Co. 39

Kahnweiler's Sons, David. 4
Katzenstein, L. & Co. 4
*Kenney Co., The. 27
Keith, J. G. & Co. 34
Kingsford Foundry & Machine Works. 30

Lane & DeGroot. 4
*Learmonth, Robert. 30
Lebanon Chain Works. 5
Lidgerwood Mfg. Co. 10
Lockwood Mnfg. Co. 4
L. S. & M. S. Ry. 39

McMyler Mfg. Co. 3
MacDonald, Ray G. 34
*Magnolia Metal Co. 1
MacKinnon Mfg. Co. 8
Mair, John & Son. 6
Marine Iron Co. 4
Marine Supply Co. 31
Martin-Barriss Co. 9
Maryland Steel Co. 5
Miller, Walter. 9
Mitchell & Co. 34
Moffat & O'Brien. 34
Monongahela Iron & Steel Co. 3
*Moran Bros. Co. 39
Morse Iron Works & Dry Dock Co. 4
Morse, Williams & Co. 9
Mott Iron Works, J. L. 10

Neafie & Levy Co. 5
*Newhall Chain Forge & Iron Co. 30
Newport News Ship Building & Dry Dock Co. 5
New Doty Mfg. Co. 12
Niles Tool Works Co. 3
Nixon, Lewis 5
North River Iron Works. 5

Olds Motor Works. 8
Osborne & Co., F. H. 34

Page Bros. & Co. 3
Parker, A. A. & B. W. 32
Pauly, H. J. 34
Peck, Chas. E. & W. F. 7
*Penberthy Injector Co. 39
Philadelphia Pneumatic Tool Co. 10
Phosphor Bronze Smelting Co., Ltd. 9
Pickands, Mather & Co. 32
Pinney, Orestes C. 34
Pittsburg Coal Co. 33
Pittsburgh Testing Laboratory, Ltd. 34
Playfair's Barge & Tug Line. 40
Powell, Ambrose V. 34
Pusey & Jones Co. 5

Queen City Engineering Co. 10

Red Star Line. 7
Richardson, W. C. 34
Risdon Iron Works. 5
*Ritchie & Sons, E. S. 30
Roach's Ship Yard. 5
Roberts Water Tube Boiler Co. 11
Rochester & Pittsburgh Coal & Iron Co. 33
*Roebling's, John A. Sons Co. 40
Rushmore Dynamo Works. 3

Safety Car Heating & Lighting Co. 31
Sands, Alfred B. & Son. 10
Scherzer Rolling Lift Bridge Co. 6
See, Horace 34
Shelby Steel Tube Co. 28
Sheriffs Mfg. Co. 10
*Signal & Control Co. 7
Simpson, Geo. A. 28
Skinner Chuck Co. 3
Smith, Edward & Co. 1
Smith, Stanley B. & Co. 33
Stratford Oakum Co., Geo. 32
Standard Chain Co. 10
Standard Oil Co. 31
Standard Releasing Hook Co. 4
*Standard Pneumatic Tool Co. 25
Stirling Co. 11
Stowe & Graydon. 34
Sturtevant, B. F. Co. 40
Swain Wrecking Co. 32

Thurston & Bates. 34
Townsend & Downey Ship Bldg. Co. 4
Trigg Co., Wm. R. 4
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Upson-Walton Co. 40
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Warren Webster & Co. 10
Westinghouse Electric & Mnfg. Co. 6
White, Johnson, McCaslin & Cannon. 34
Willard, Chas. P. & Co. 8
Wilson, Thomas 34
Wilson & Silsby. 6
Wood, W. J. 34
*Wood & Co., R. D. 30
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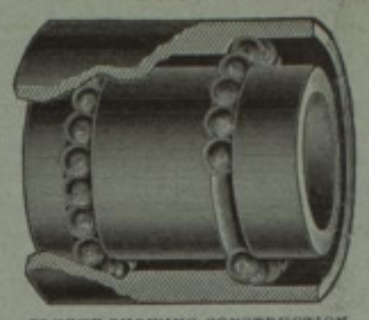

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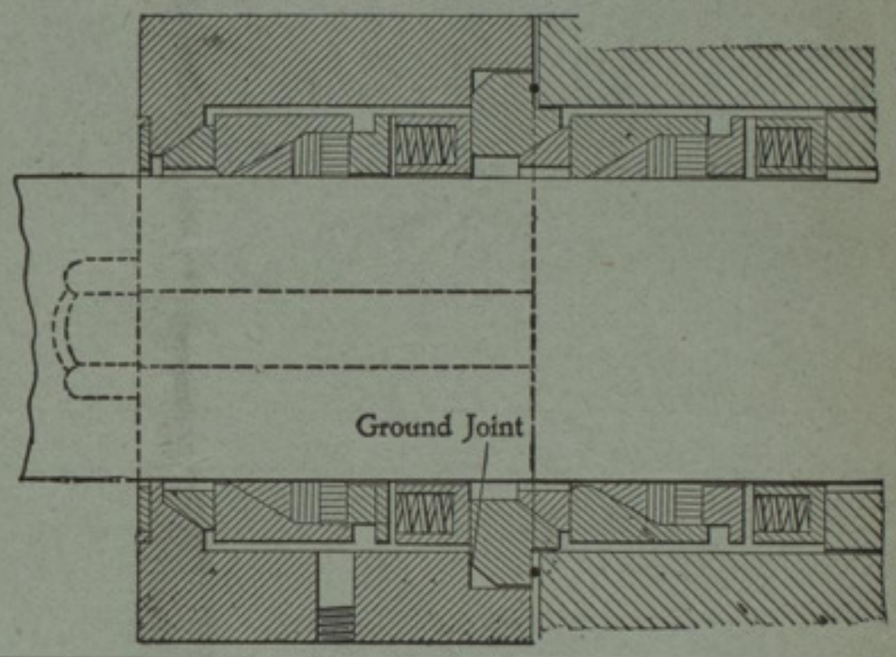

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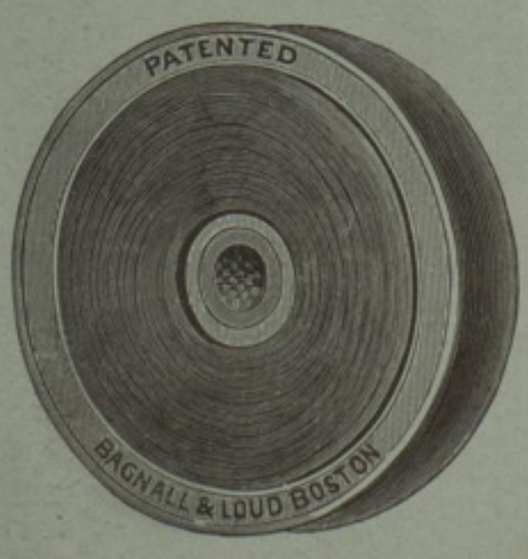

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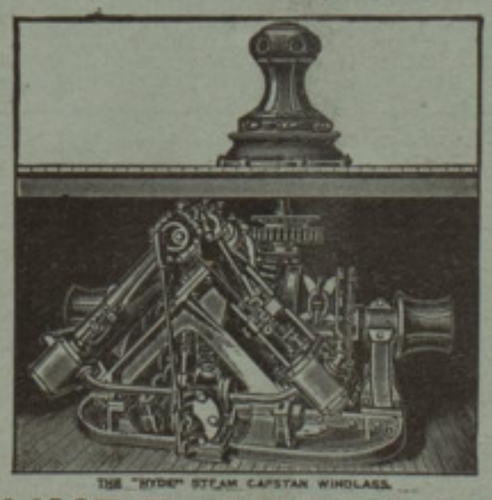

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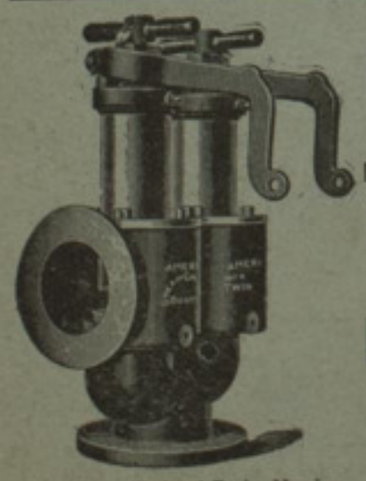

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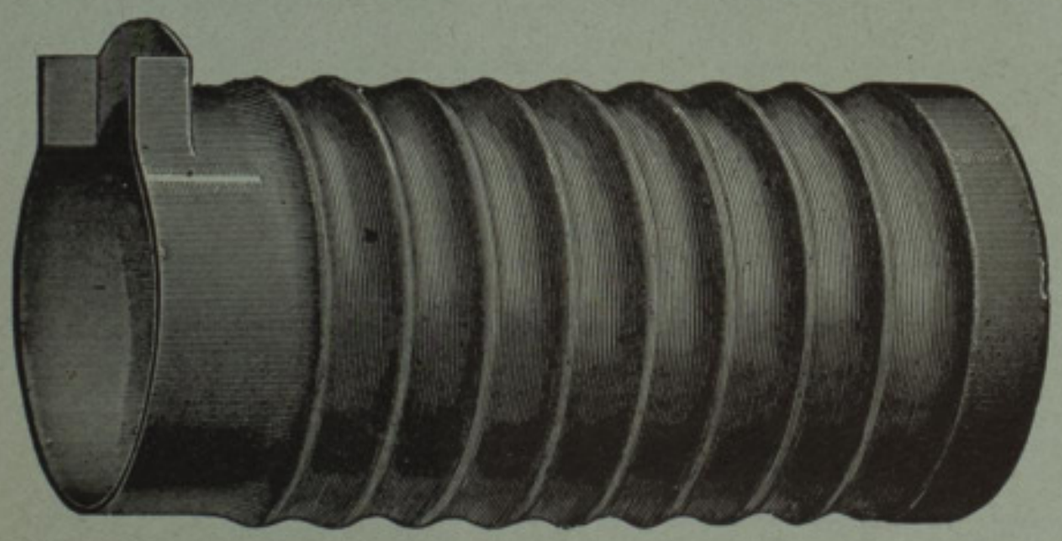

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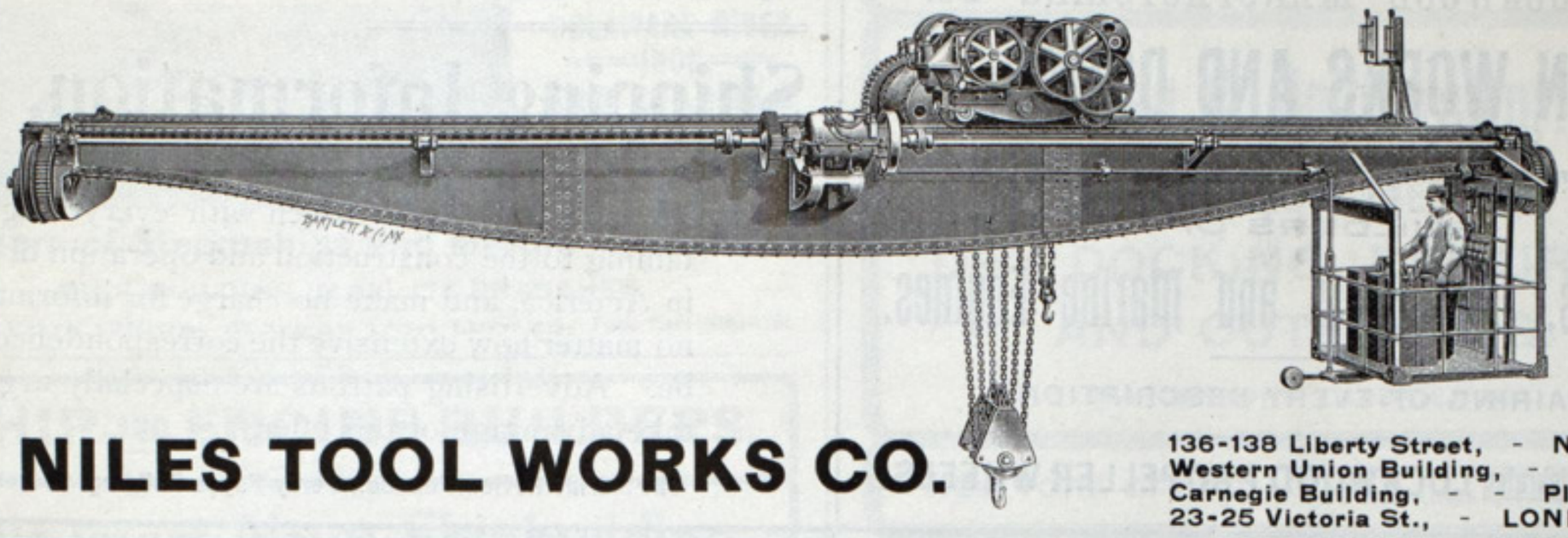

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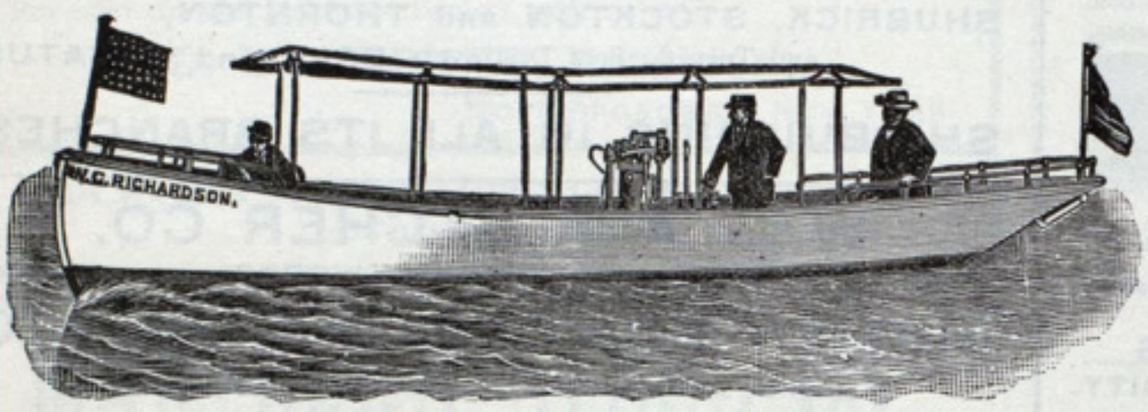

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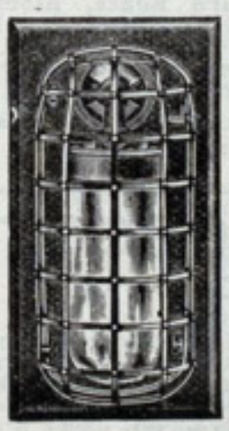

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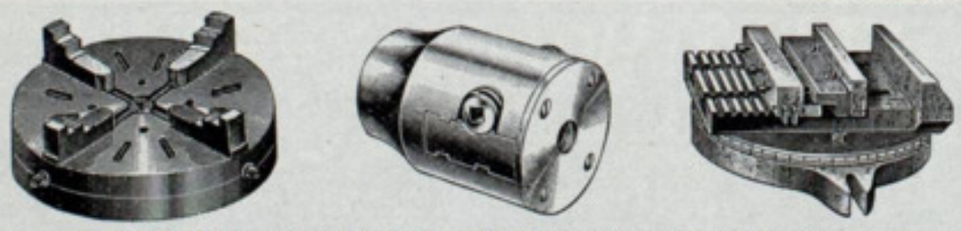

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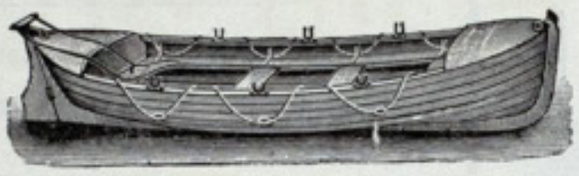

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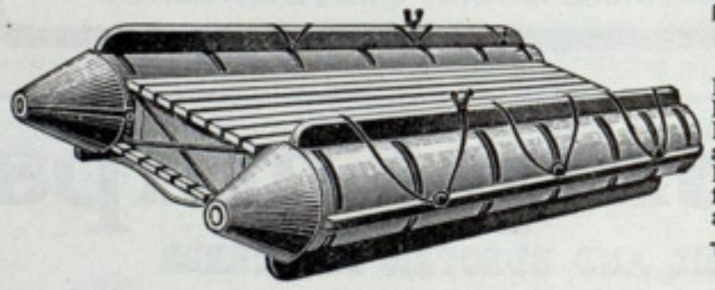

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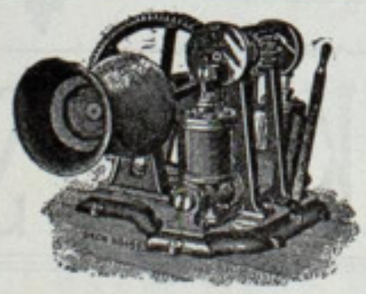

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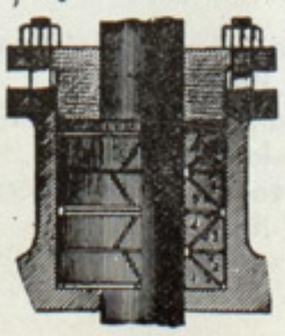

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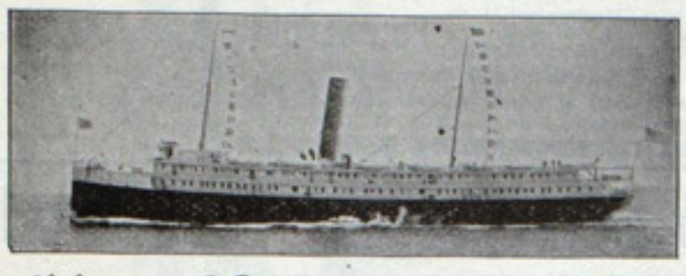

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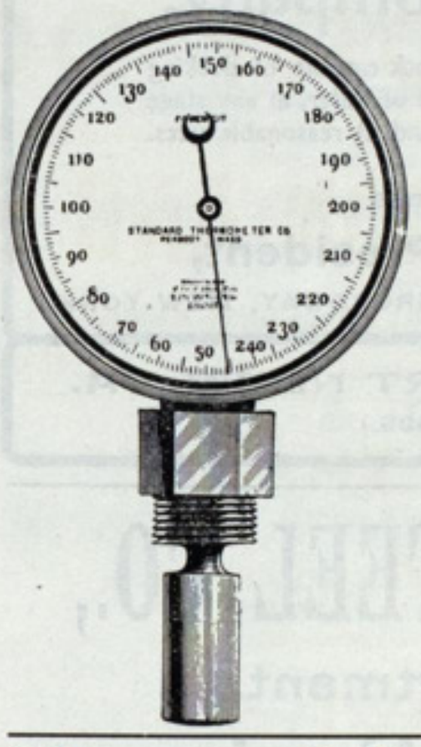

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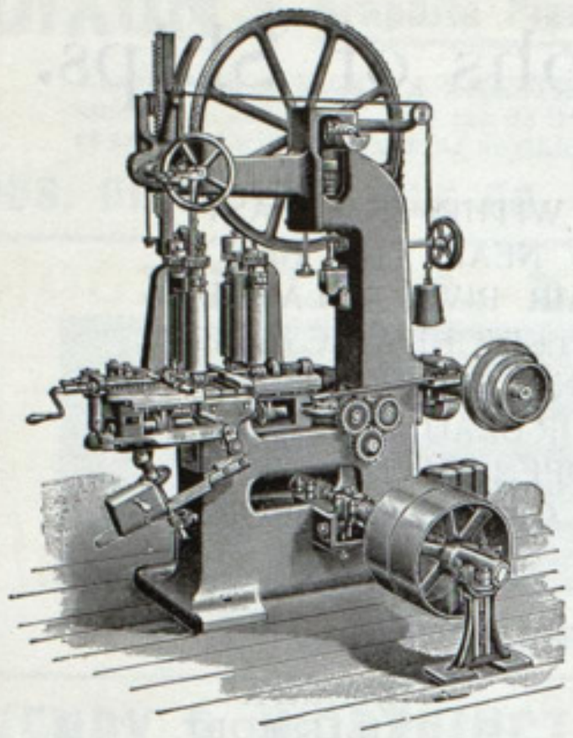

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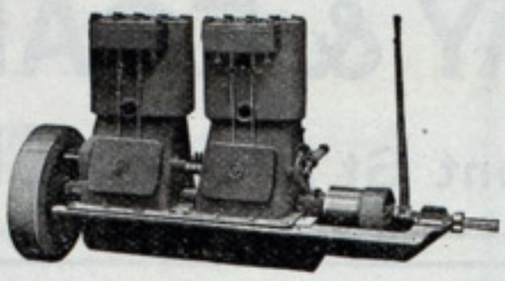

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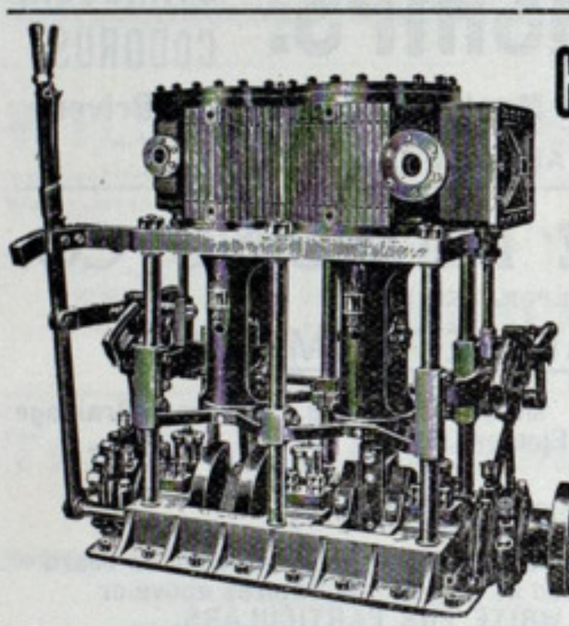

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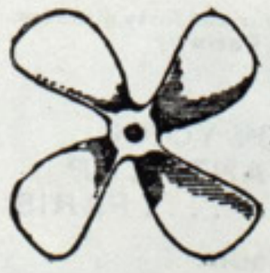

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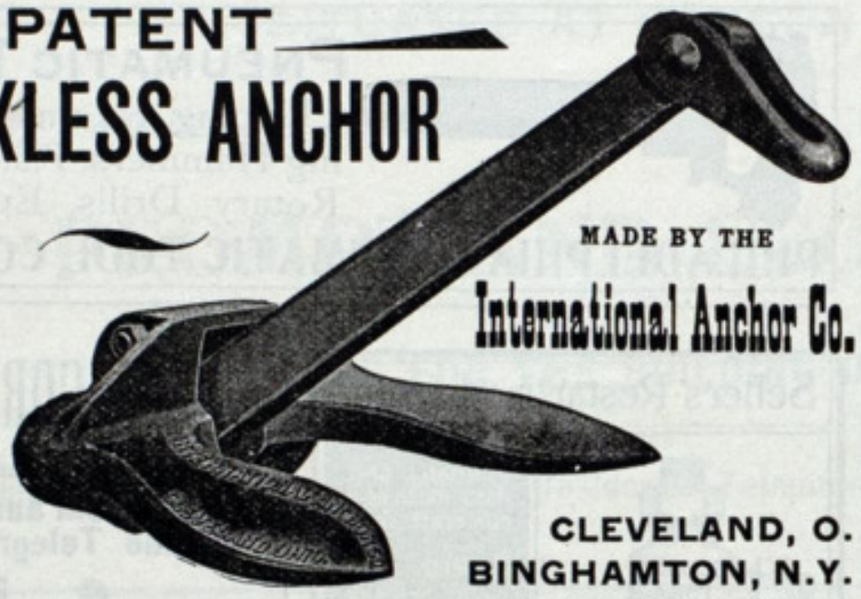

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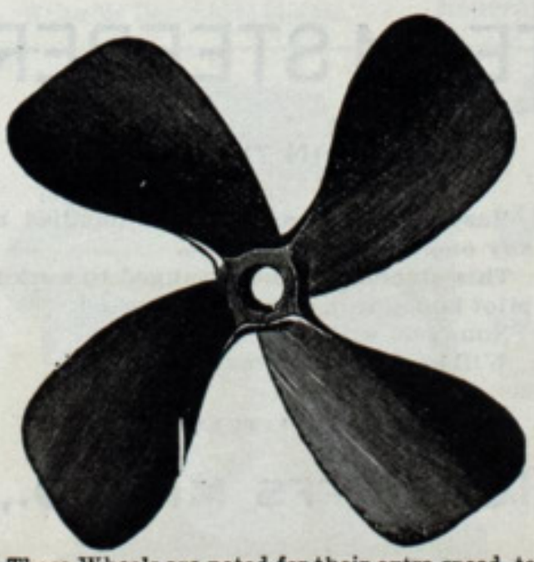

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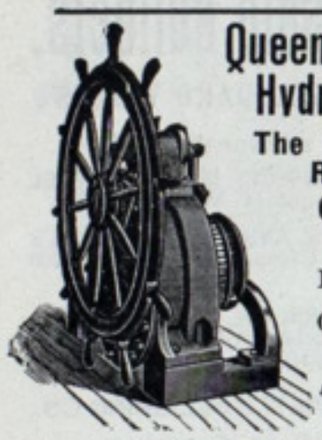

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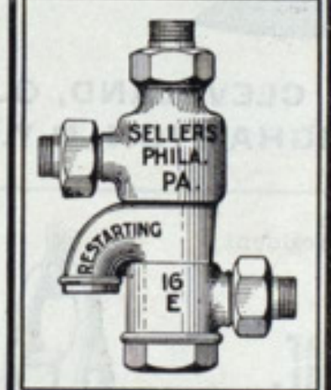

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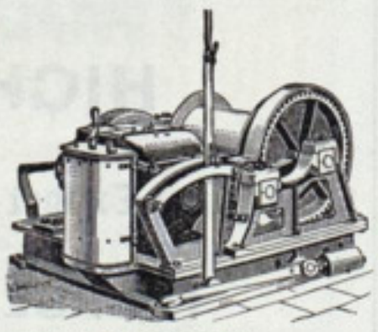

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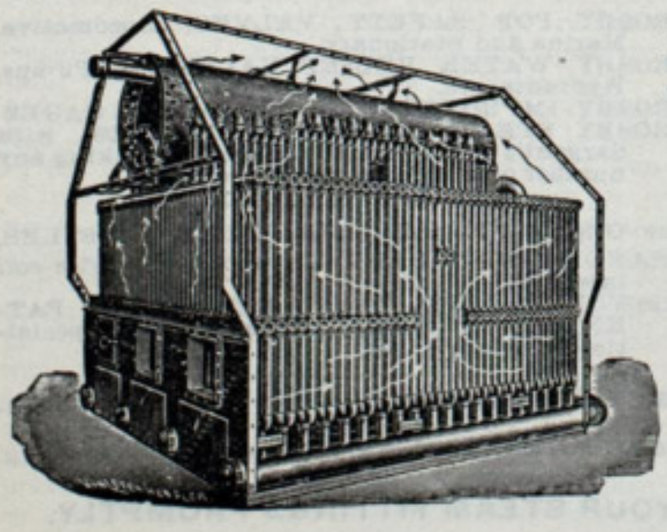

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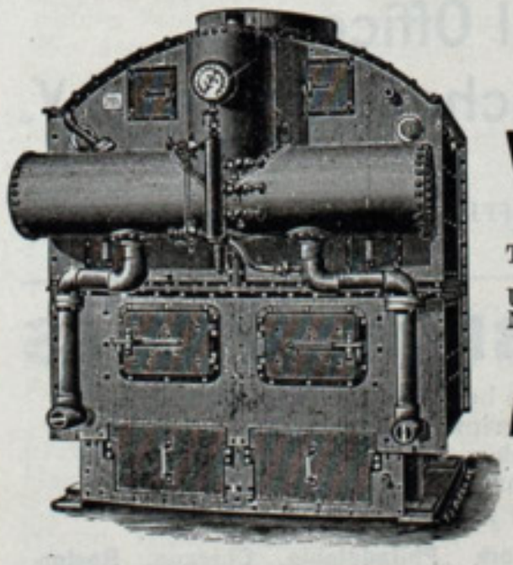

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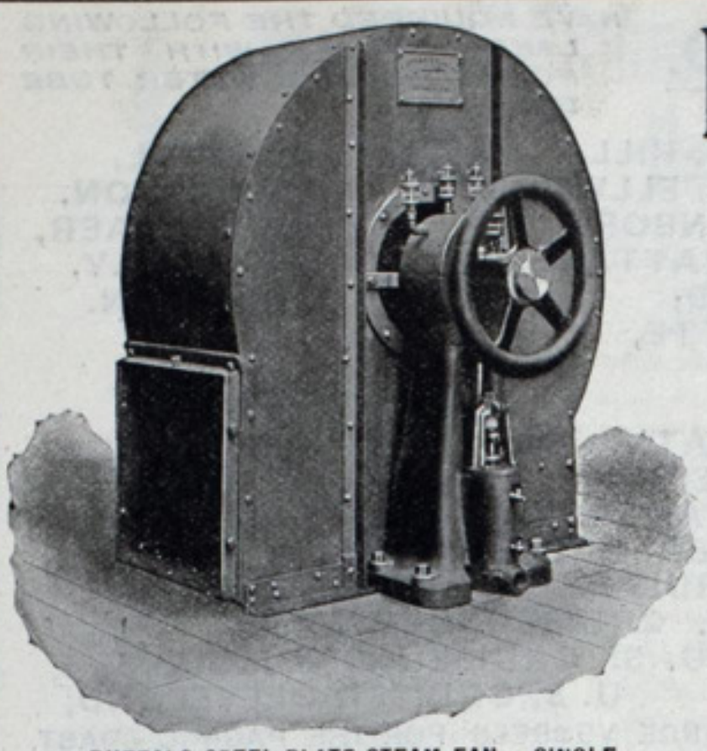

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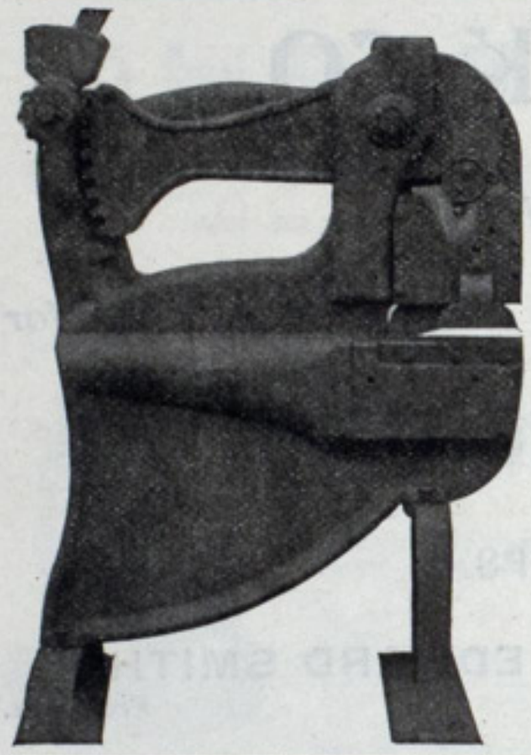

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